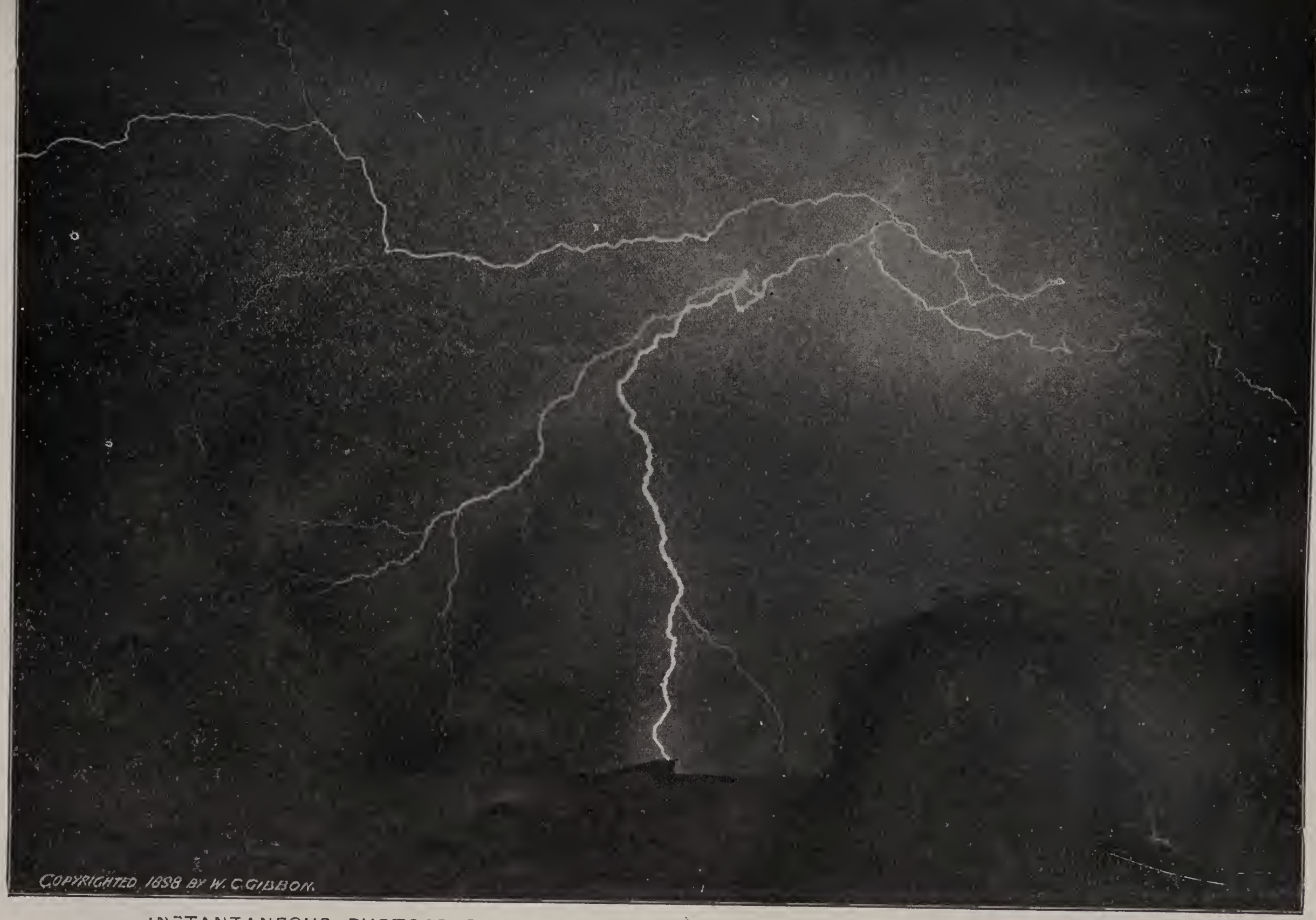
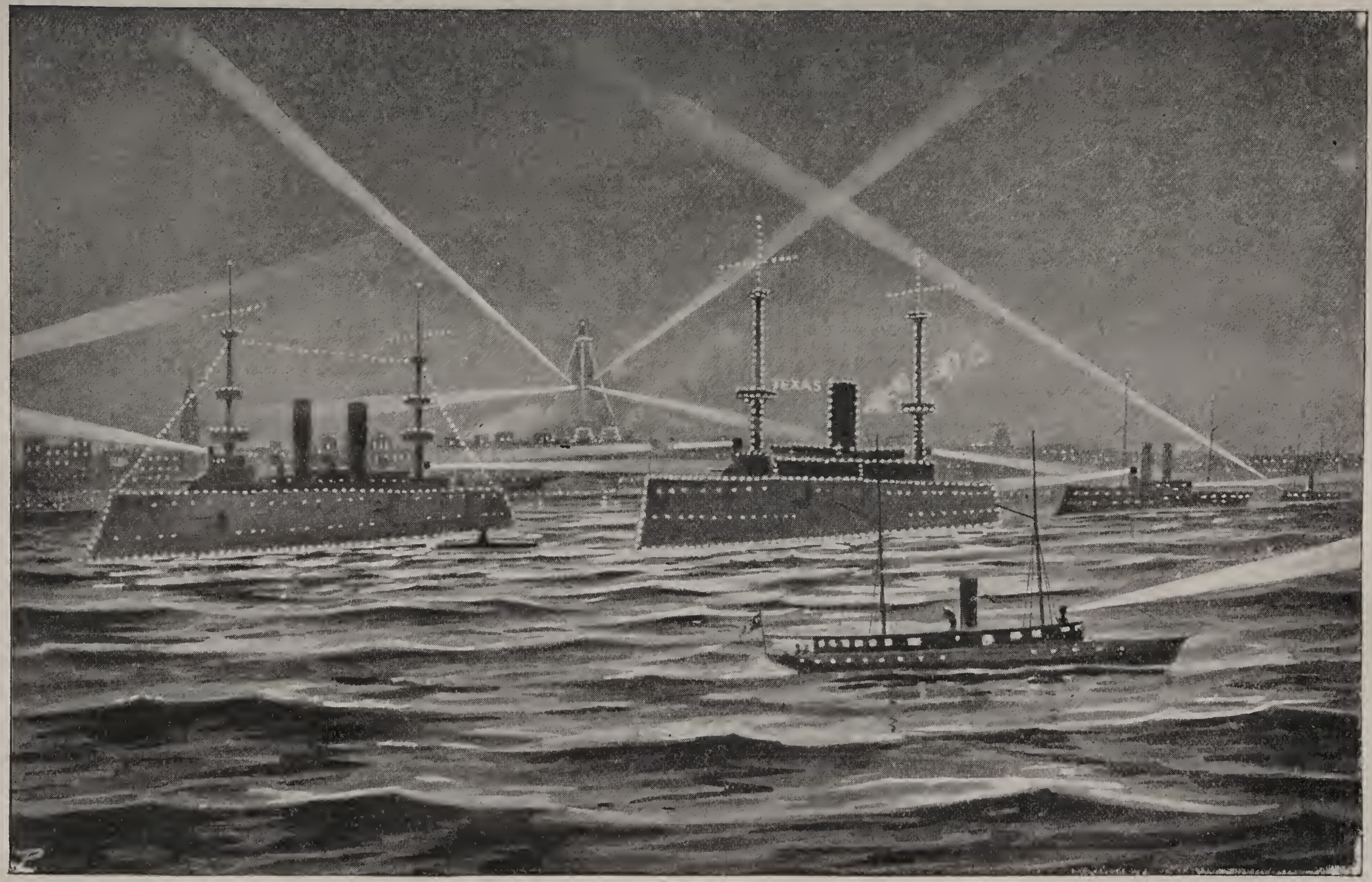


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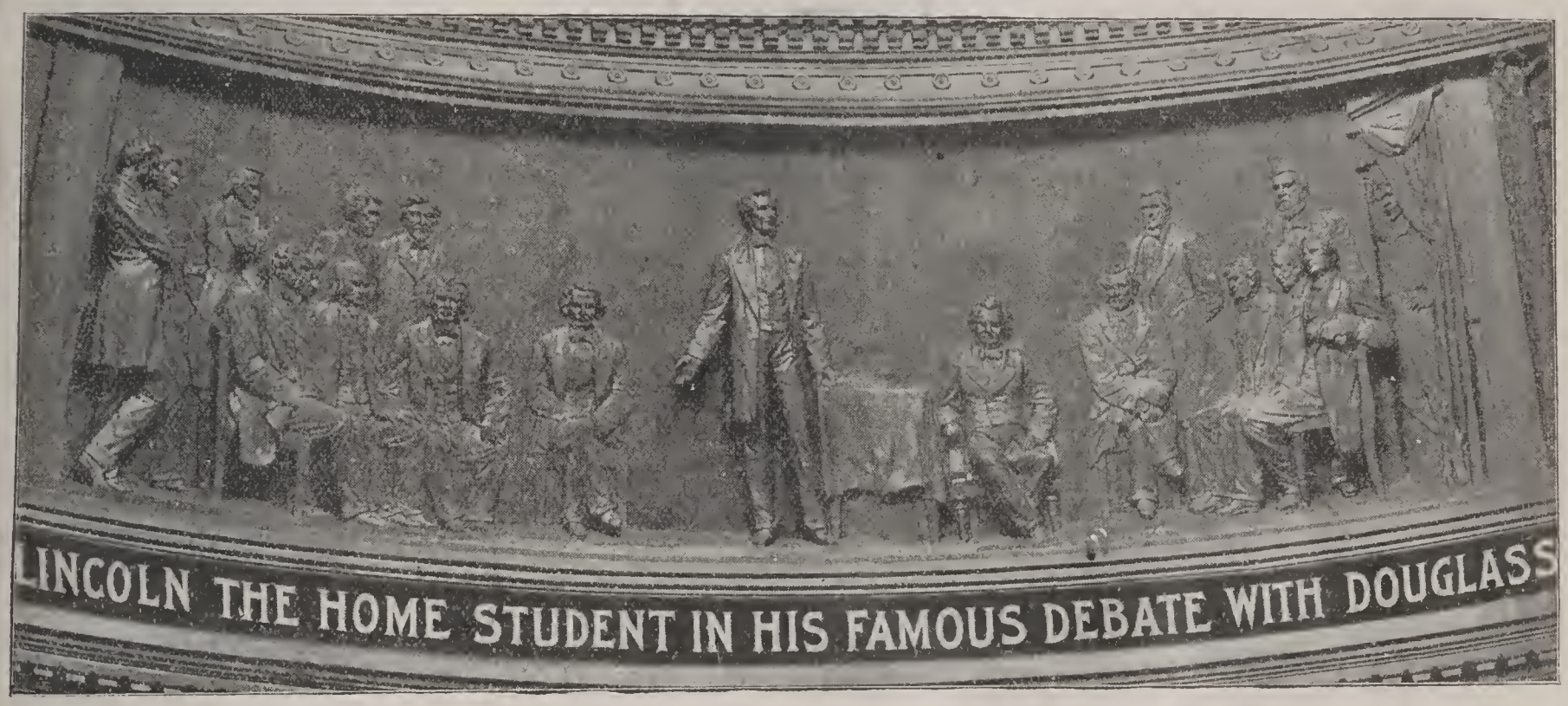
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PREFACE.

OUR grandparents were wont to tell us of the awe and skepticism that everyone expressed when, during the last century, steam was first used as a motive power, and by means of electricity the first message was flashed over Morse's telegraph. But the era of marvelous discovery and invention, of stupendous enterprises and fabulous fortunes was, as it were, yet in its infancy. To-day we are on the threshold of a new epoch: we have ushered out the wonderful Nineteenth Century, and words fail us when we think what new marvels are yet to be brought forth from bounteous nature by the aid of the hand and brain of Man.

Sufficiently awe-inspiring is it to gaze about us at the inventions of the last twenty years and understand in what a grand and glorious age we are living. History tells us of the Golden Age of Greece, of the fabulous wealth of the Orient, of the marvels of the armies of Xerxes and of Cæsar, of the brilliancy of the all-absorbing Roman Empire, and of the later years when Shakespeare lived, and artists, poets, and wise men were aided by rich gifts from Kings and Queens and encouraged in their search for wisdom.

The discovery of America was a wonderful history maker, and accomplished almost in a day what years of careful study could not have proved. But what are we to say of this, the most marvelous country of them all?

To-day we have so subdued nature that we have harnessed the great Niagara, and hourly convert by means of great turbines many thousands of volts of electricity to be used in aiding the ways of commerce. By means of the weirdest of all discoveries,—the X Rays,—we can now gaze in contemplation on the beatings of the human heart, secure within its fortress of muscle and ribs.

Air has been reduced to liquid substance, so cold that mercury when brought in contact with it is frozen solid as rock. The wizards of electricity are at work perfecting the wonderful wireless telegraph, and means of transmitting electrical power for light without wires is expected soon to be achieved. To-day we are able to photograph moving objects, and reproduce them life-like in form and size and graceful motion.

Such are some of the wonders wrought within recent years; we dare not scoff at what the future may bring forth. What we should do, however, is to keep abreast of the times,—to know of the age in which we live. And it is no

easy task, when one must glean from this newspaper and from that magazine, and catch fragmentary pieces of a subject here and there and try to retain them in this busy hus'ling and bustling life long enough to gain a fair understanding and form opinions of them.

With this thought in view the publishers of this magnificent volume have spared no expense to present to the intelligent reading public a comprehensive and thoroughly up-to-date encyclopædia of the latest inventions and improvements in the scientific and mechanical world; the work is primarily intended for busy people who desire facts, yet who wish to be spared the labor of long and unsatisfactory researches through libraries, museums, and histories.

In the space alloted to science in this delightful book are described the latest marvels: liquid air, the wireless telegraph, the new uses of the X Ray, the advance in experiments toward the perfect air ship, telegraphing pictures, and many other wonderful feats never before dreamed of.

Then follows a number of very interesting accounts of inventions along the mechanical line, though many partake of the nature of the scientific. Here the reader learns that the dreams of Jules Verne have come true, and that man may now safely travel the bottom of the sea. Besides submarine boats, there are here treated such subjects as battleships and modern war engines, moving pictures, great engineering feats, automobiles, bridges, canals, monster printing presses, type-setting machines, iron and steel mills and foundries and stereotyping processes. The modern tall building or "sky scraper" is described in its various stages of construction.

And after these history making machines comes some of the history they have changed. Here are to be read and seen portrayed in picture the travels and discoveries of the wise men of the world; the acquisition of the new territory of the United States: Porto Rico, Hawaii and the Philippines; the great Peace Conference, called by the Czar of all the Russias; the war in South Africa, our marvelous growth in commerce and shipping, the cattle industry, and the stock yards at Chicago. Here we shall learn how great newspapers are made and circulated, and how trusts are organized.

Many young men and women are embarrassed by responsibilities they cannot throw off. He or she may not be able to attend college or go to the great cities for learning; but no one need be ignorant with such mines of information as this book lays before them. Indeed, they who will not learn may go their poor deluded ways; but those who are struggling upward and onward, striving to learn and to know, to gain knowledge, and with knowledge power, will find in the following pages a way open for higher, better and nobler achievements.

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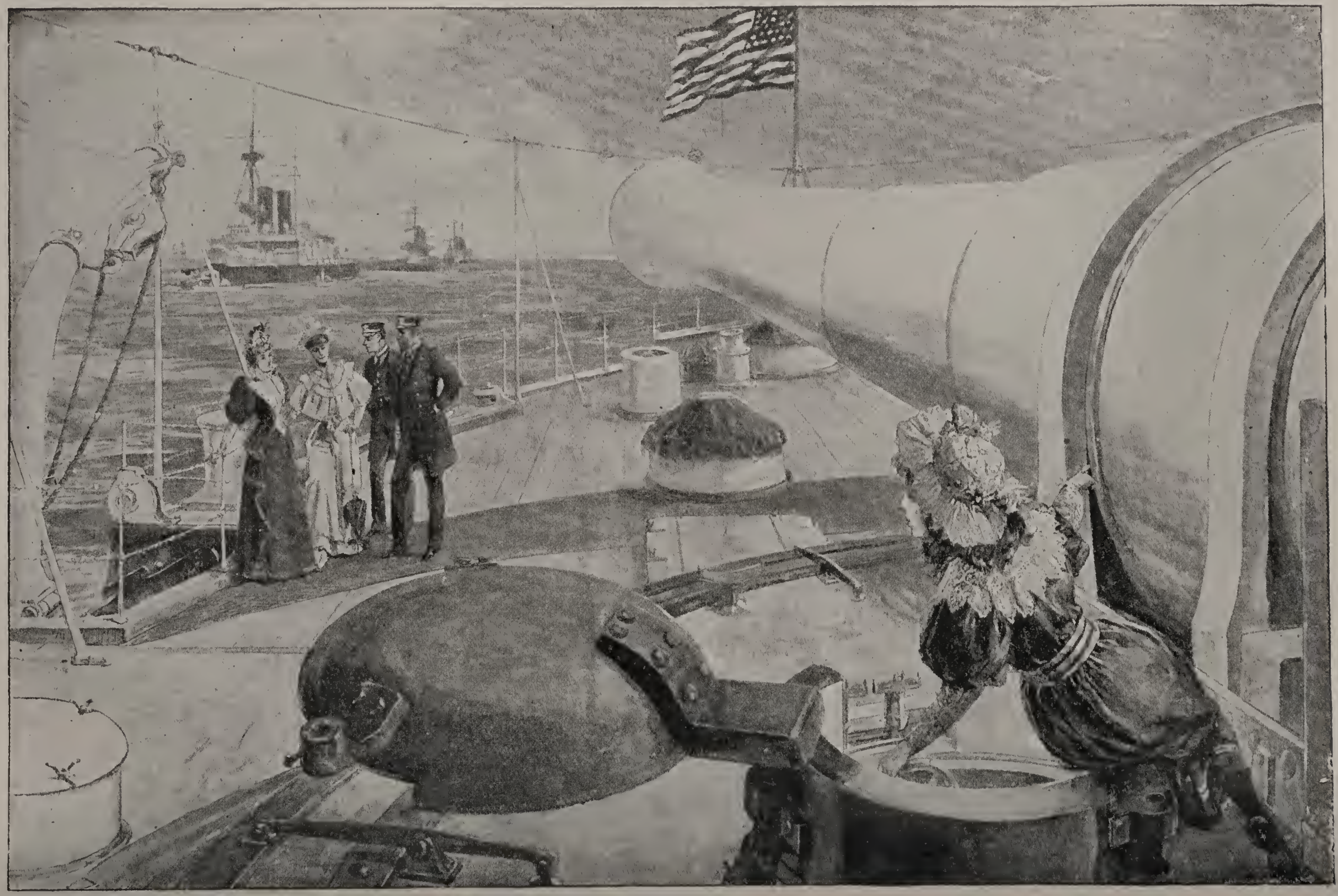
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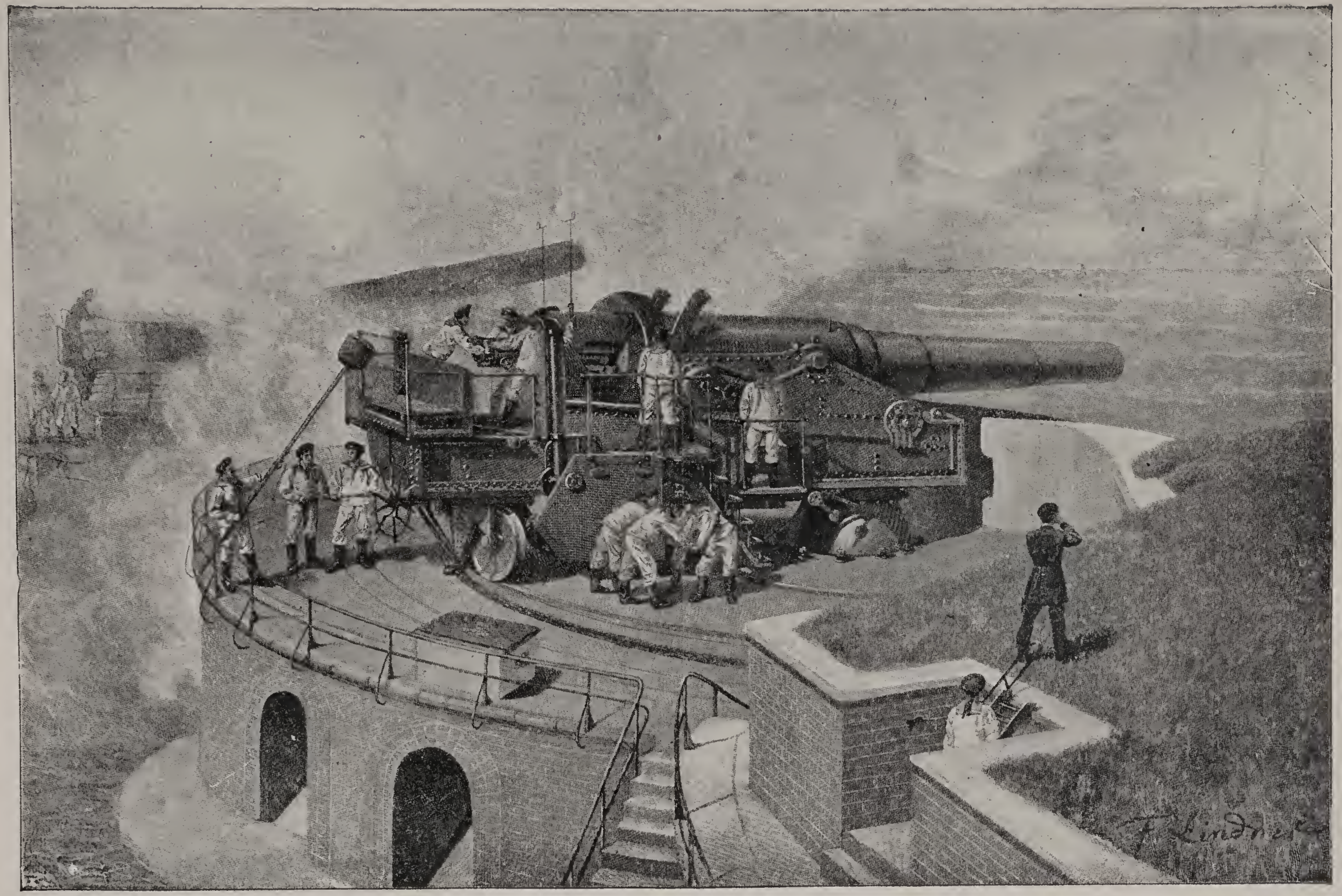
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THE AUTOMOBILE IN WAR—RAPID-FIRE GUNS USED BY THE ENGLISH TROOPS AT THE DEFENCE OF LADYSMITH



VISITORS ON BOARD A MAN-OF-WAR—A LITTLE CHILD MOVES A GUN WEIGHING 67 TONS



REVOLVING GUN USED FOR COAST DEFENCE



STUDENTS OF PRACTICAL DESIGN AT WORK—SCHOOL OF INDUSTRIAL ART, BOSTON

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EDUCATION

The Training of Mind and Body

AMONG the wise and pithy sayings of one of our best known modern writers is this: If a man empties his purse into his head, no man can take it away from him. An investment in knowledge always pays the best interest.

It is by diligent attention to this rule that the highest success is gained. It is impossible to have the noblest type of man, physically, intellectually or morally, without education. An uneducated ploughboy cannot reach the commanding heights of the widest influence; with education he may rise to the highest position his country can bestow.

The biographies of the greatest statesmen, scholars, men of letters, philosophers and others who have gained distinction, invaribly represent them as possessed of an eager thirst for knowledge. Sir Isaac Newton was in the habit of spending whole nights in the study of astronomy and the laws that govern the heavenly bodies. Without such close application he could not have made those immortal discoveries which have been the wonder of all thoughtful minds from his time until the present.

It is the observation of one of our modern writers that a human being is not, in any proper sense, a human being until he is educated. Thus his slumbering faculties are aroused. The magnificent displays of knowledge dawn upon him as the morning light brings beauty and fruitfulness to the earth. The word education means to train, to instruct, to awaken our faculties to action; or, taking the word in its primary sense, it means "to draw out." It aims at the growth and highest possible culture of the whole man, and the most valuable means for securing this grand result are found in books of useful knowledge and information. These are the tools with which the rough block is chiselled into symmetry and beauty.

The fruits of the earth do not more obviously require labor and cultivation to prepare them for our use and subsistence than our faculties demand instruction and regulation in order to qualify us to become upright and valuable members of society, useful to others, or happy in ourselves. We must be disciplined and trained.

Education is a friend which no misfortune can estrange; a companion that never becomes wearisome; a light that never grows dim; a solace that never fails. It is the helper of the poor and unfortunate, the handmaid of genius, an introduction abroad, and an ornament in every walk of society. Without it, what is man—what can be but an untutored savage?

What sculpture is to a block of marble, education is to the mind. The philosopher, the saint, the hero, the wise, the good, the great, often lie hidden and concealed in some unnoticed individual, which a proper education might have disinterred and brought to light.

The True Motto.

Education begins with life. Before we are aware the foundatioms of the future structure are laid. Busy pursuits, the struggle for daily bread, and the toil that cannot be escaped, crowd out the opportunity to engage in the pursuit of knowledge, but if we take the correct view of this most important matter, we shall hold that education is never finished, that there is always something new to learn, that the highest summit has not been reached, and we shall still, in the spirit of Longfellow's "Excelsior," press upward with a noble resolve, and a determination that is daunted by no difficulty or failure.

Too apt are we to take a narrow, limited view of self-training. One boy is educated to be a bookkeeper; another, to be a draughtsman; another, to be a stenographer; another, to be an electrician; another, to be a lawyer or journalist. It is true that special training is needed for special pursuits, and no less true that the whole man needs to be educated, whatever may be the subsequent calling to be followed. All other training is like lopping off the branches on one side of the tree and causing them to grow only on the other side—very good branches, perhaps, but a very misshapen tree.

Hear what Daniel Webster said: Knowledge does not comprise all which is contained in the large term of education. The feelings are to be disciplined; the passions are to be restrained; true and worthy motives are to be inspired; a profound religious feeling is to be instilled, and pure morality inculcated under all circumstances. All this is comprised in education.

Said Washington—and our entire history since his day has proved the sagacity of his remark: Promote, as an object of primary importance, institutions for the general diffusion of knowledge. In proportion as the structure of a government gives force to public opinion, it is essential that public opinion should be enlightened. The Father of his Country was firm in the conviction that ignorance should have no place among a free people.

An Old Legend.

There is an old fable in classical Mythology which pictures Hydra as a serpent crawling in the slime of marshy Lerna—a monster with many heads, anyone of which, if cut off, was replaced by two others unless the wound was cauterized. The horrid creature was slain by Hercules; this was one of the giant's famous achievements. No less true is it that ignorance is a hydra with a thousand heads, ugly, dangerous, demonish, and the Hercules that alone can slay it is that knowledge which comes from enlightened education.

One of our martyred Presidents said: Next in importance to freedom and justice is popular education, without which neither freedom nor justice can be maintained. This means that more than banks, railroads, factories, commercial structures thirteen stories

high —more than all the sails of commerce and all the ploughs that turn up golden harvests from prairies, is that thorough training which fits the citizens of a free commonwealth for their duties and responsibilities.

William Penn, writing to his wife concerning their children, said: For their learning be liberal. Spare no cost; for by such parsimony all is lost that is saved; but let it be useful knowledge, such as is consistent with truth and godliness, not cherishing a vain conversation or idle mind; ingenuity, mixed with industry, is good for the body and the mind, too.

Thus, have the fathers and founders of our nation urged, insisted upon, and demanded, all the advantages of a liberal education. fortunately, these have been provided for all.

SELF CULTURE

NO one will deny that a large and very important part of mental and physical training is furnished by parents and teachers. Their influence is vast and far-reaching. If it were not so, if the school-master and professor had no hand in forming mind and character, the doors of our schools and academies might as well be shut and nailed up.

As wrapt and hidden in the stone's embrace
  The future statue lies yet undefined;
  Till the nice chisel clears the form designed,
The trunk, the moving limbs, the speaking face
Develops: so instruction's hand must trace
  The intellectual form, which lies enshrined
  'Mid nature's rude materials; and the mind
Invest with due proportion, strength and grace.
God, to thy teaching, delegates the art
  To form the future man: the care be thine,
No shape unworthy from the marble start,
  Reptile or monster; but with just design
Copy the heavenly model, and impart,
  As best thou canst, similitude divine.

But what can others do for us compared with what we can do for ourselves? Books are our teachers and the printer's type rules the world.

Very justly it has been said by a recent writer: We all have two educations, one from others, and another which we give ourselves. It is this last education which determines our standing in society, and our actual condition in life, and our fate hereafter. All the professors and teachers in the world would not make you a wise or good man without your own co-operation; and if such you are determined to be, the want of them will not cause you to fail. We are to make the most of ourselves. It should be the duty of education to make men first and noble deeds will follow.

The educated man is the one who wears the crown—the man who can learn from reading and observation and then apply what he knows. Every manufacturer, and every other employer, knows the vast differ

ence between an educated and uneducated workman. Two men come, soliciting work. One is boorish in appearance, ungrammatical in speech, dull in comprehension because his faculties have never been sharpened; he seems to be little less than a machine and with scarcely more comprehension. The other is bright, quick, speaks correctly, gives evidence of self-training and capacity. By his side the other presents a pitiable spectacle, and in the competition is distanced, as a trained sprinter outstrips a man on wooden legs. This is something occurring around us every day and within the commonest observation.

Great Value of Ready Information.

In all education a knowledge of men and things is indispensable. For this reason the cultured classes of Europe, and to some extent of our own country, have considered it essential for the boy or girl who has passed through the schoolroom and mastered the course of study, to seek information from other sources; to take a trip through the outside world and lay in a fund of such knowledge as can be obtained only by observing the daily doings of ordinary life and the people who are the actors in events of constant occurrence. The eye is the prime teacher. Open it and keep it open. Look, examine, ask questions, and do not be ashamed to ask.

Knock on the lids of books, packed with useful information, and say, "I am here to learn what you have to tell me. We are to become well acquainted; I am going to keep company with you; teach me, surprise me, store my mind with knowledge; unfold your secrets: let me into the sanctum; I have come to stay, and mean to traverse your charming pages until they are worn to a beaten path."

Say this to your books of thought, of knowledge, of all practical information. We say practical, for there is much that you do not need to know, and would not make you wiser if you did know. Common sense is the most uncommon, but it is the best. What will be useful for everyday life, teaching you how to think, to feel, to act, to succeed, to make the most of yourself, to step up higher and higher on the ladder of fame and fortune—this is what your book should teach.

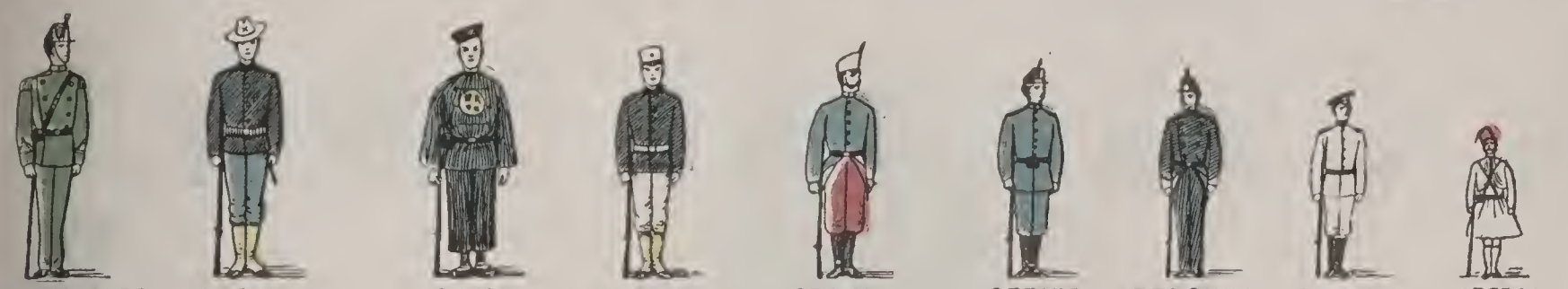
Gold Must be Refined.

There is sure to come a time when those who have neglected self-culture in early life see the great mistake they have made; they regret it when perhaps it is too late. Although they are conscious of their own defects, their ignorance and sad lack of education, they have not time and opportunity to apply the remedy. You should, therefore, make the most of your advantages while you have them.

Very bright minds may remain in eclipse for want of cultivation. The diamond is not allowed to continue in its rough state; it must be cut and polished. Gold must be separated from the rude ore; it is of small account until this is done. Cicero says, cultivation to the mind is as necessary as food to the body. Soil uncultivated may produce the most luxuriant weeds, yet only weeds; it must be plowed, hoed, harrowed before it will produce good fruit.

Chesterfield said: I am very sure that any man of common understanding may, by culture, care, attention and labor, make himself whatever he pleases, except a great poet. This is only a part of the testimony that is given by the great minds of all ages, affirming that close application and rigorous discipline are essential to the highest attainments and the most brilliant success.

THE FIGHTING STRENGTH OF THE PRINCIPAL NATIONS OF THE WORLD.



NETHERLANDS	U.S.A.	CHINA.	JAPAN	SPAIN	SERVIA	BELGIUM	BULGARIA	GREECE
PEACE 116,748	65,000-100,000	100,000	87,874	86,110	66,050	57,722	35,400	18,700
WAR-248,748	6,000,000	OVER4,000,000	402,274	1,094,110	256,050	182,722	233,400	*224,800

ARRANGED AS TO RELATIVE SIZE OF STANDING ARMIES. GIVING WAR FOOTING BELOW.



RUSSIA	GERMANY	FRANCE	AUSTRIA	GREAT BRITAIN	ITALY	TURKEY	SWITZERLAND
PEACE 883,146	691,870	579,870	265,608	254,491	211,906	211,500	139,710
WAR 5,473,902	5,620,212	4,902,506	1,763,619	612,500	2,035,990	1,324,200	496,710

PRINCIPAL NAVIES OF THE WORLD

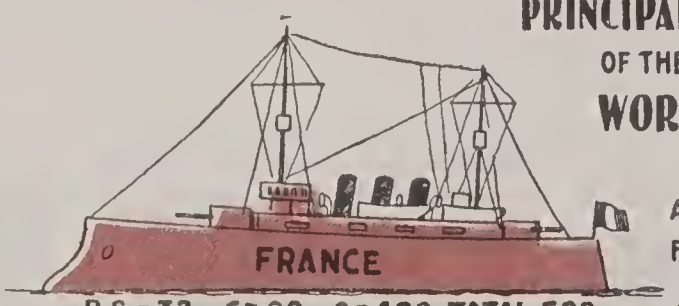
ARRANGED IN ORDER OF FIGHTING STRENGTH

GIVING ALSO THE NO. OF WARSHIPS.

B.S.=BATTLESHIP
C.=CRUISERS
O.=ALL OTHERS



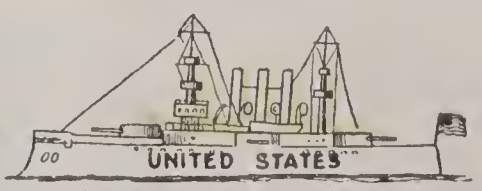
B.S.=70, C.=214, O=402, TOTAL 686.



B.S.=32, C=92 O=428, TOTAL 502



B.S.=17, C.=56, O=201 = 274



B.S.=18, C.=49, O.=146=213



B.S.=23, C.=55, O.=275, =353



275= SHIPS



144 SHIPS

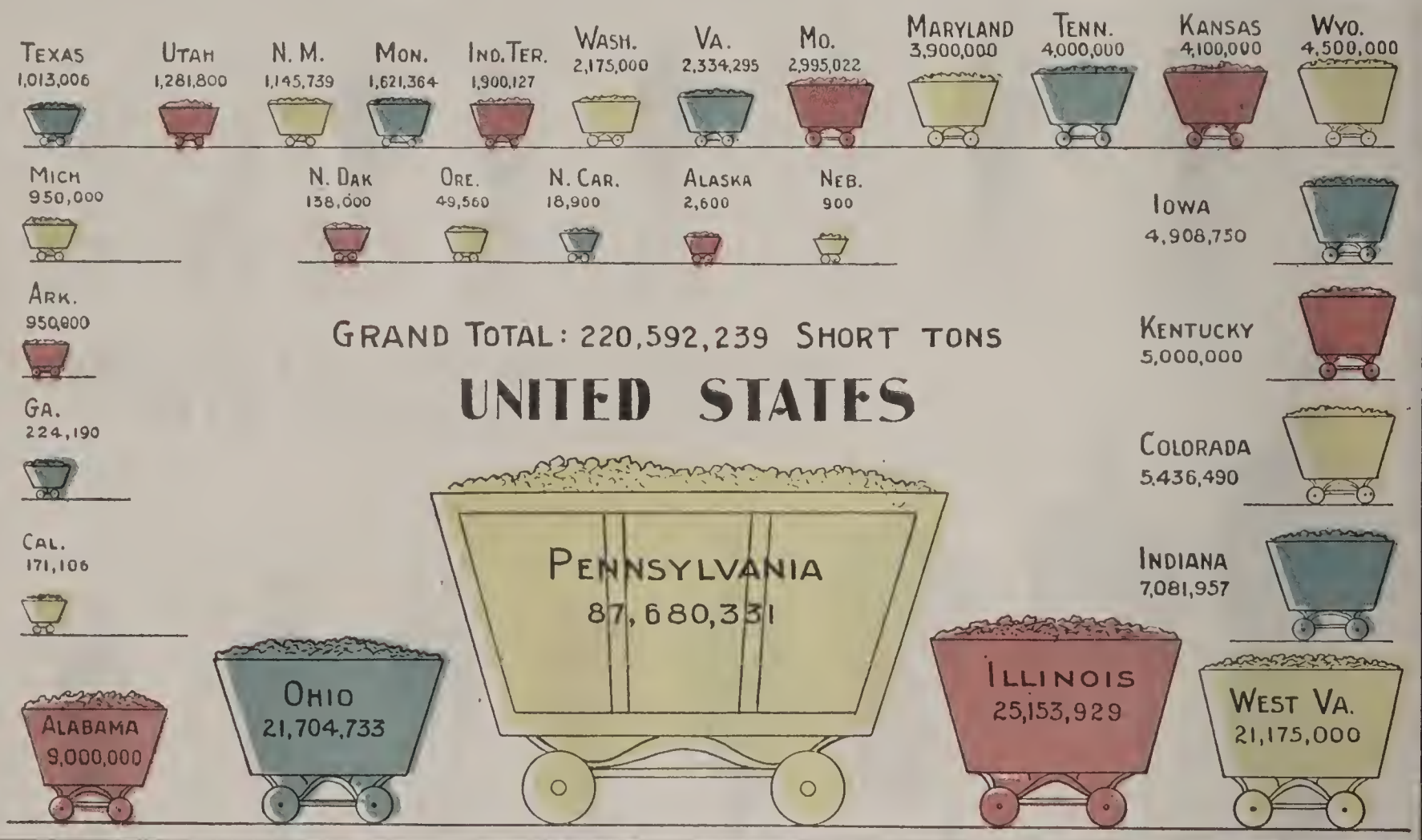


120 SHIPS

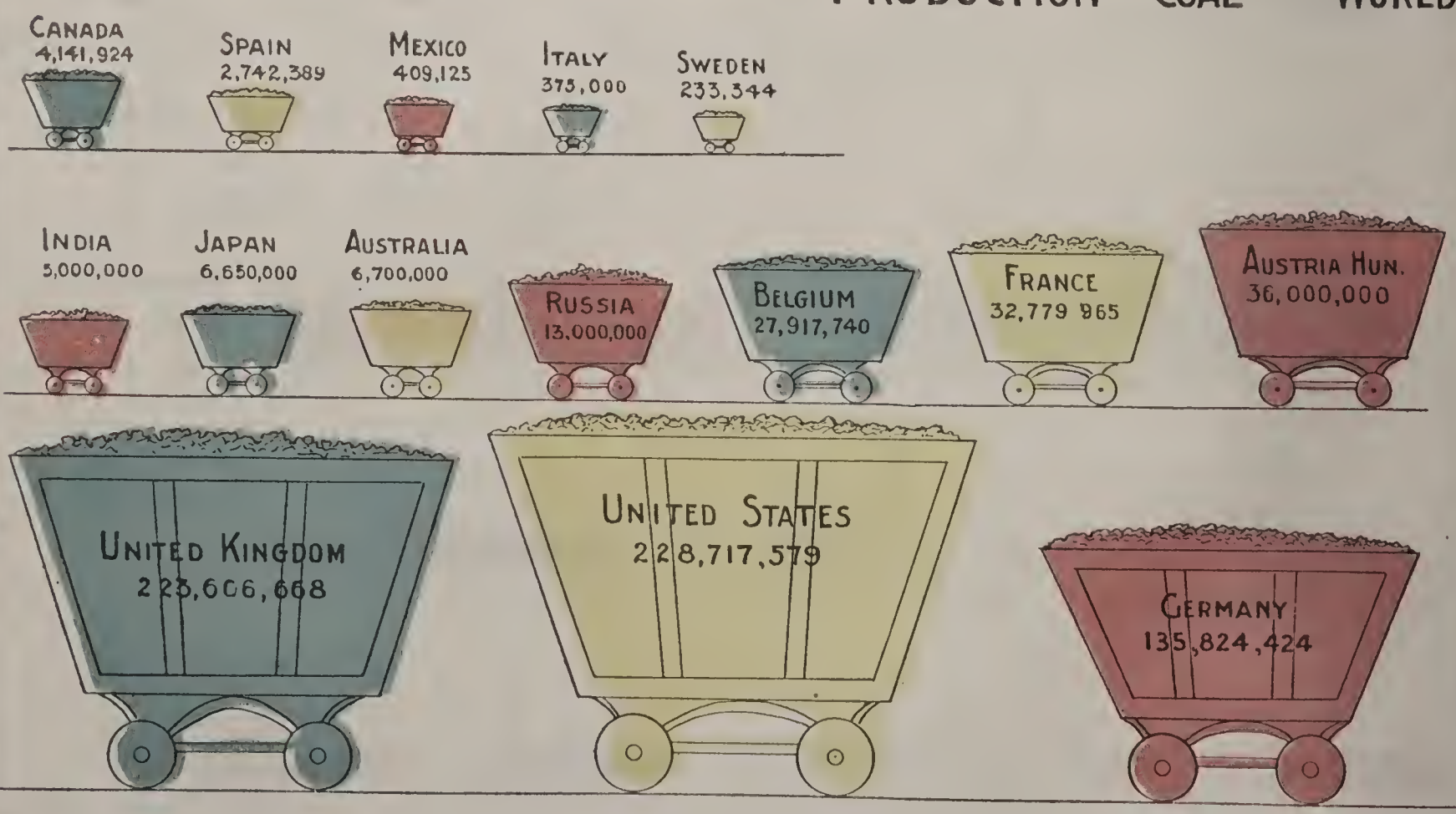


230 SHIPS

COAL PRODUCTION FOR ONE YEAR IN THE UNITED STATES AND OTHER COAL PRODUCING COUNTRIES

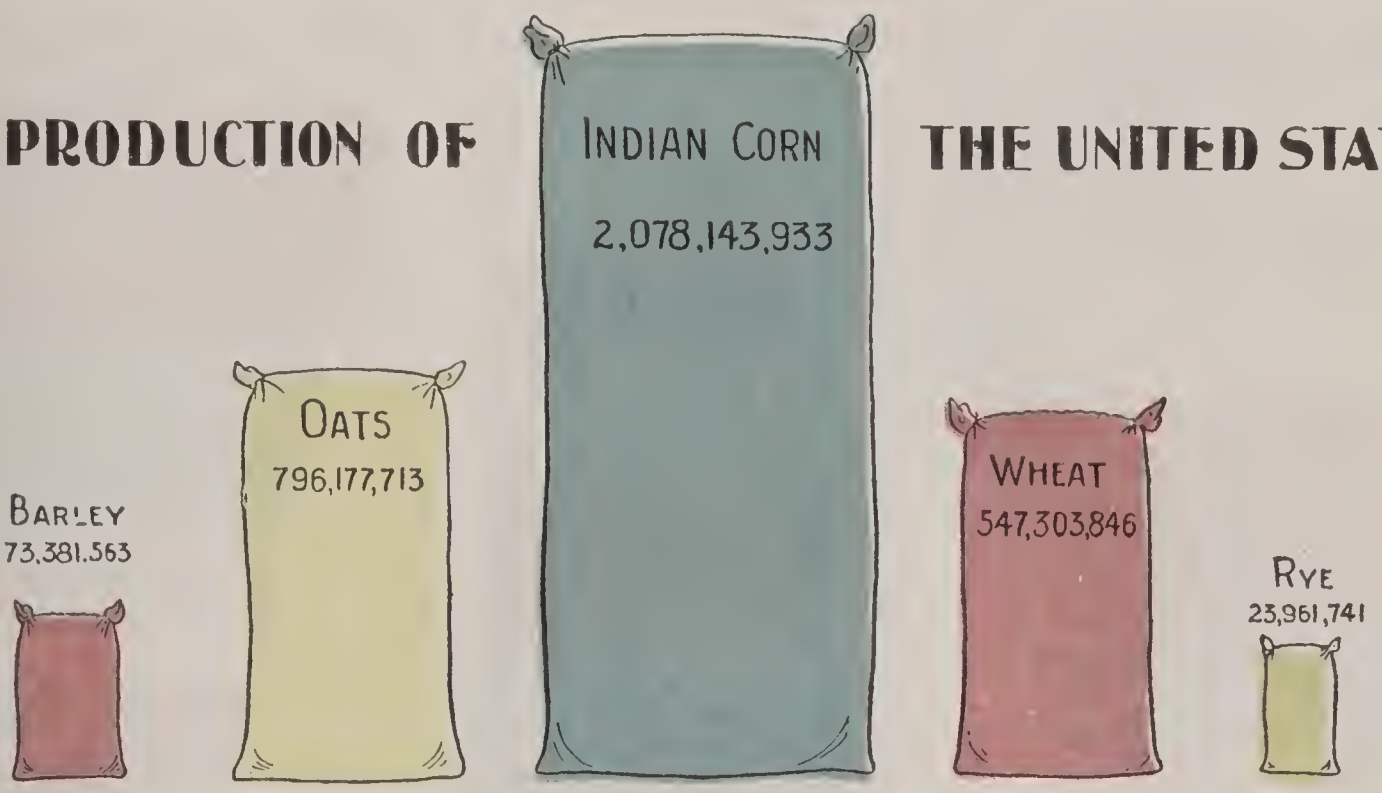


Production of Coal in the World

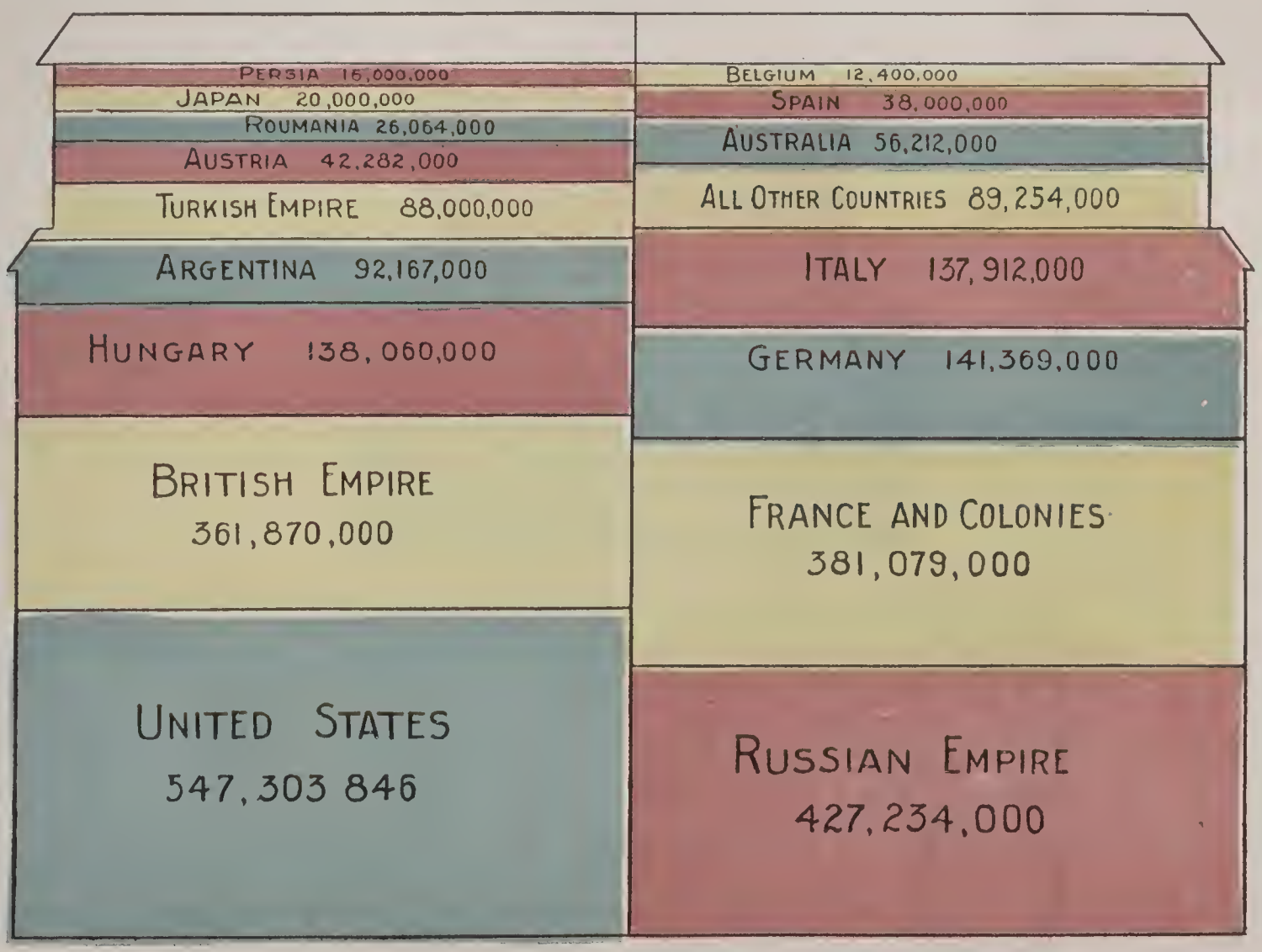


CEREAL PRODUCTION IN BUSHELS

GRAIN PRODUCTION OF THE UNITED STATES



WORLDS' PRODUCTION OF WHEAT



COTTON CROP OF THE UNITED STATES

SPINDLES IN OPERATION AND COTTON CONSUMPTION OF THE WORLD

SPINDLES IN OPERATION 1900.

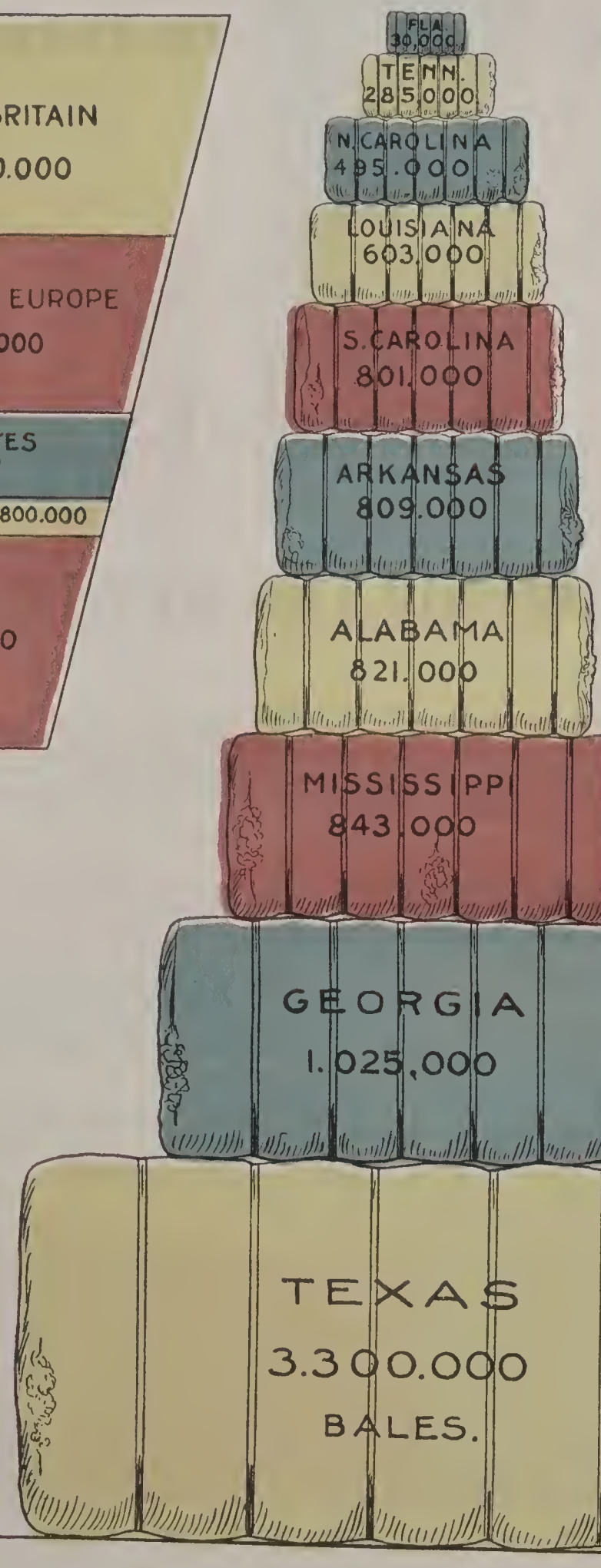
GREAT BRITAIN
45.400.000

CONTINENT of EUROPE
33.000.000

UNITED STATES
18.590.000

EAST INDIES 4.800.000

TOTAL
101.790.000



COTTON CONSUMPTION OF WORLD 1900

CONTINENT of EUROPE
4.576.000
BALES

UNITED STATES
3.856 600

GREAT BRITAIN
3.334.000

INDIA 980.000

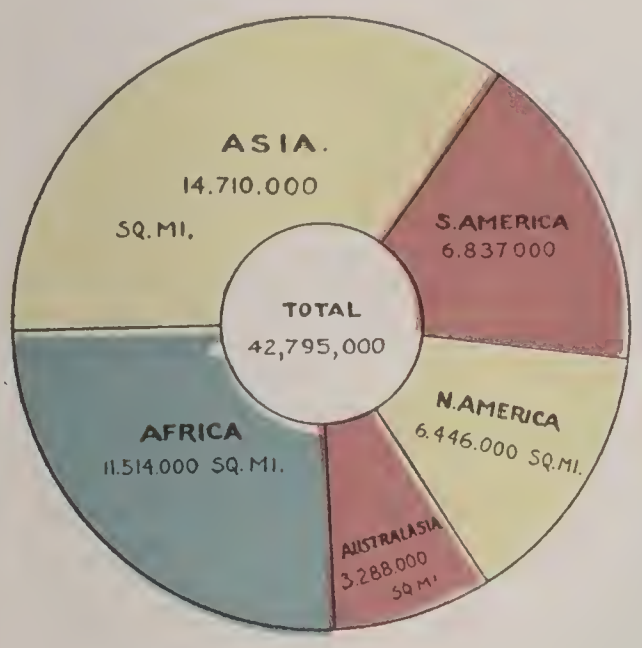
ALL OTHERS 789.000

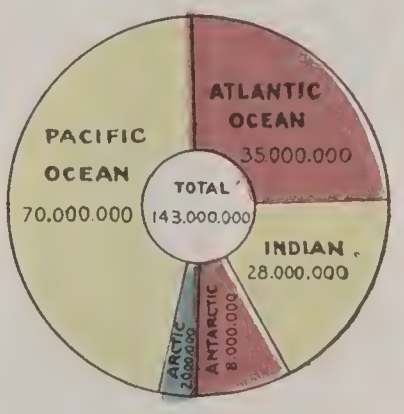
TOTAL CONSUMPTION
13.535.600
NOT INCLUDING
CANADA &
MEXICO.

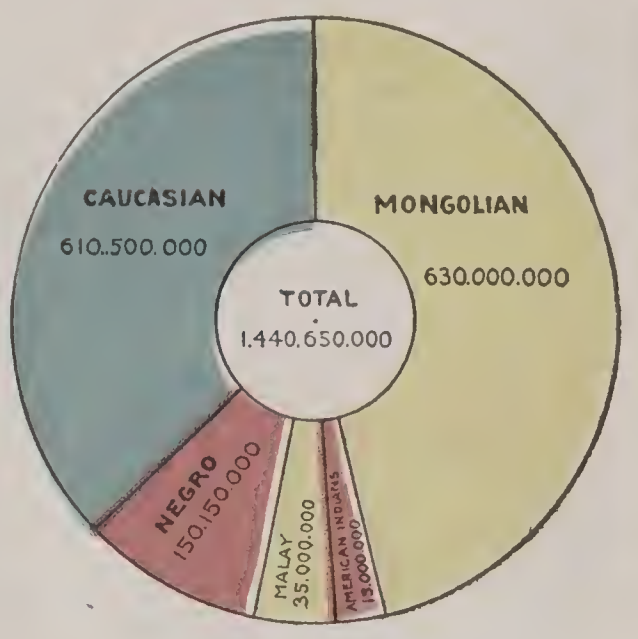
353,000

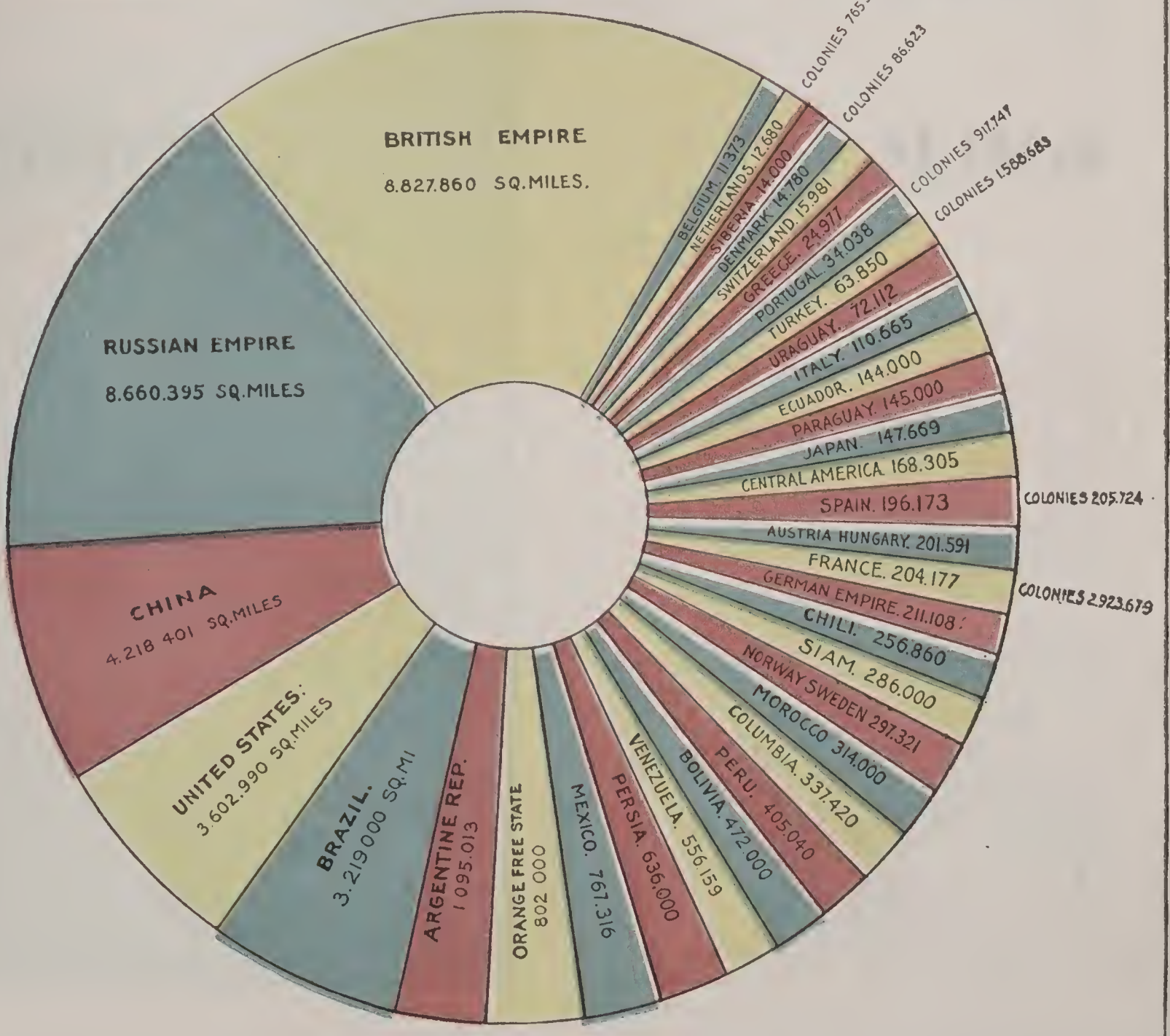
PRODUCTS OF STATES
NOT MENTIONED.

AREA OF THE WORLD IN SQ. MILES
AND
POPULATION OF THE EARTH ACCORDING TO RACE

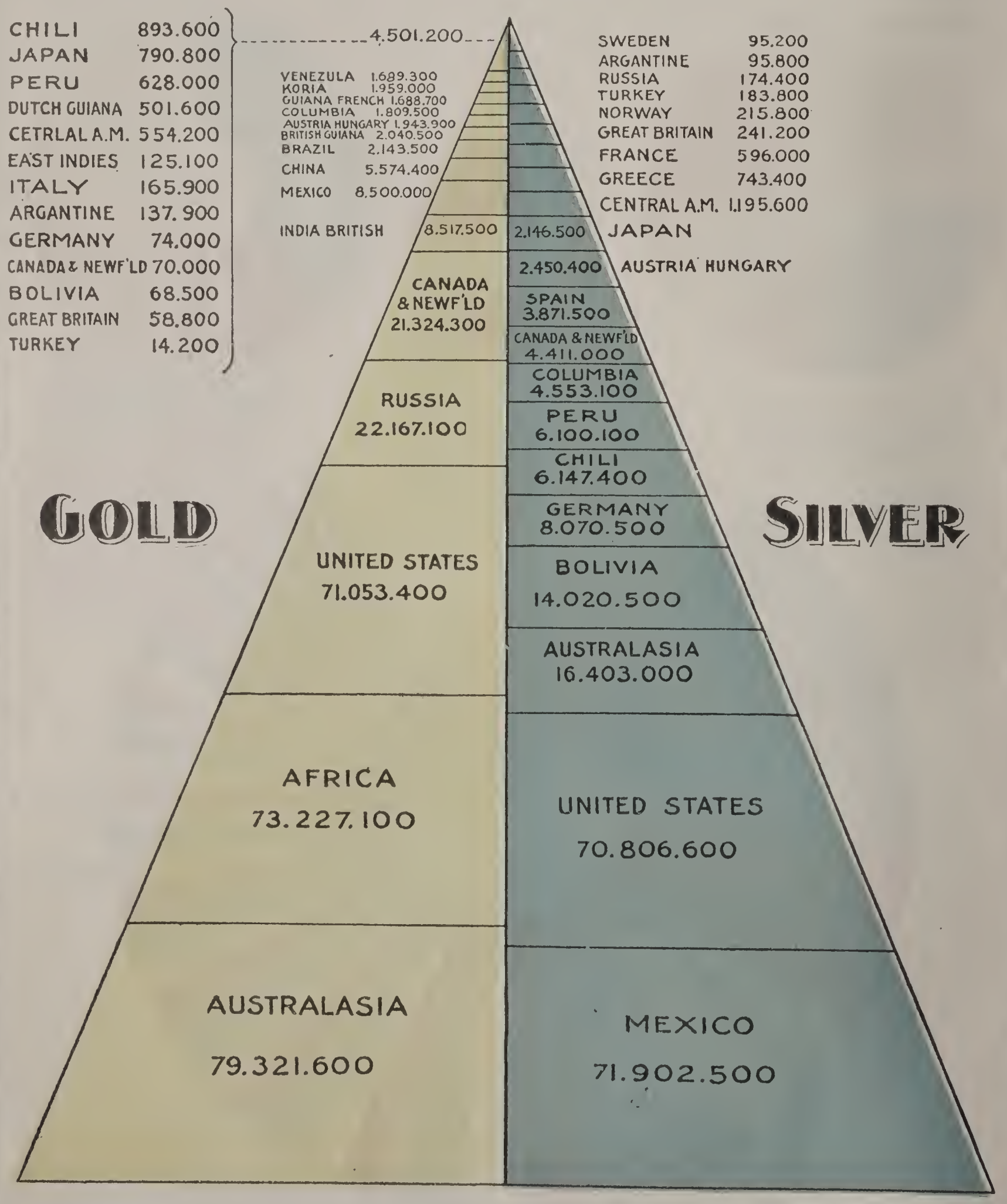






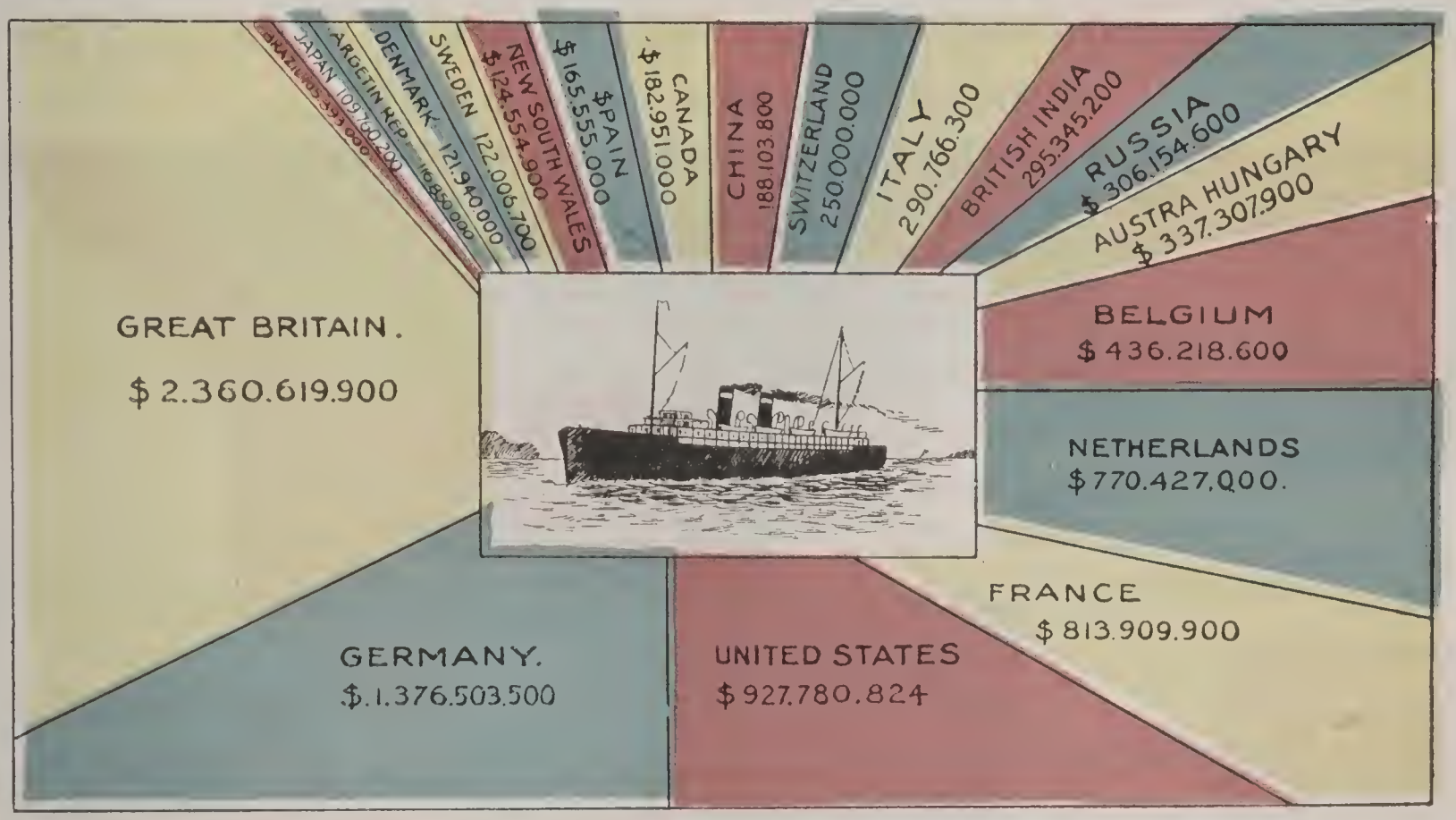


WORLDS PRODUCTION OF GOLD AND SILVER
ACCORDING TO COINING VALUE

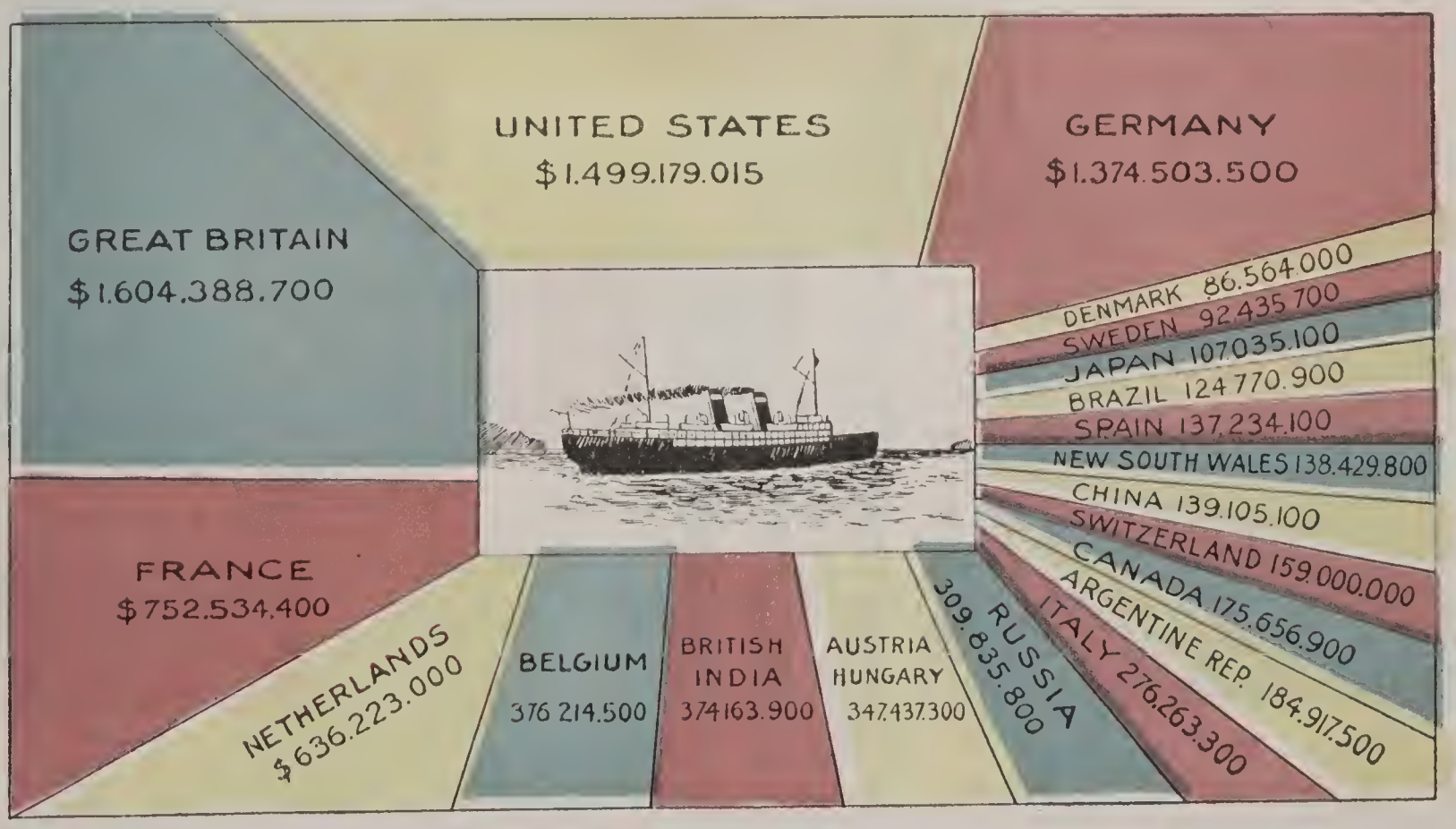


IMPORTS AND EXPORTS OF THE PRINCIPAL COUNTRIES OF THE WORLD

IMPORTS

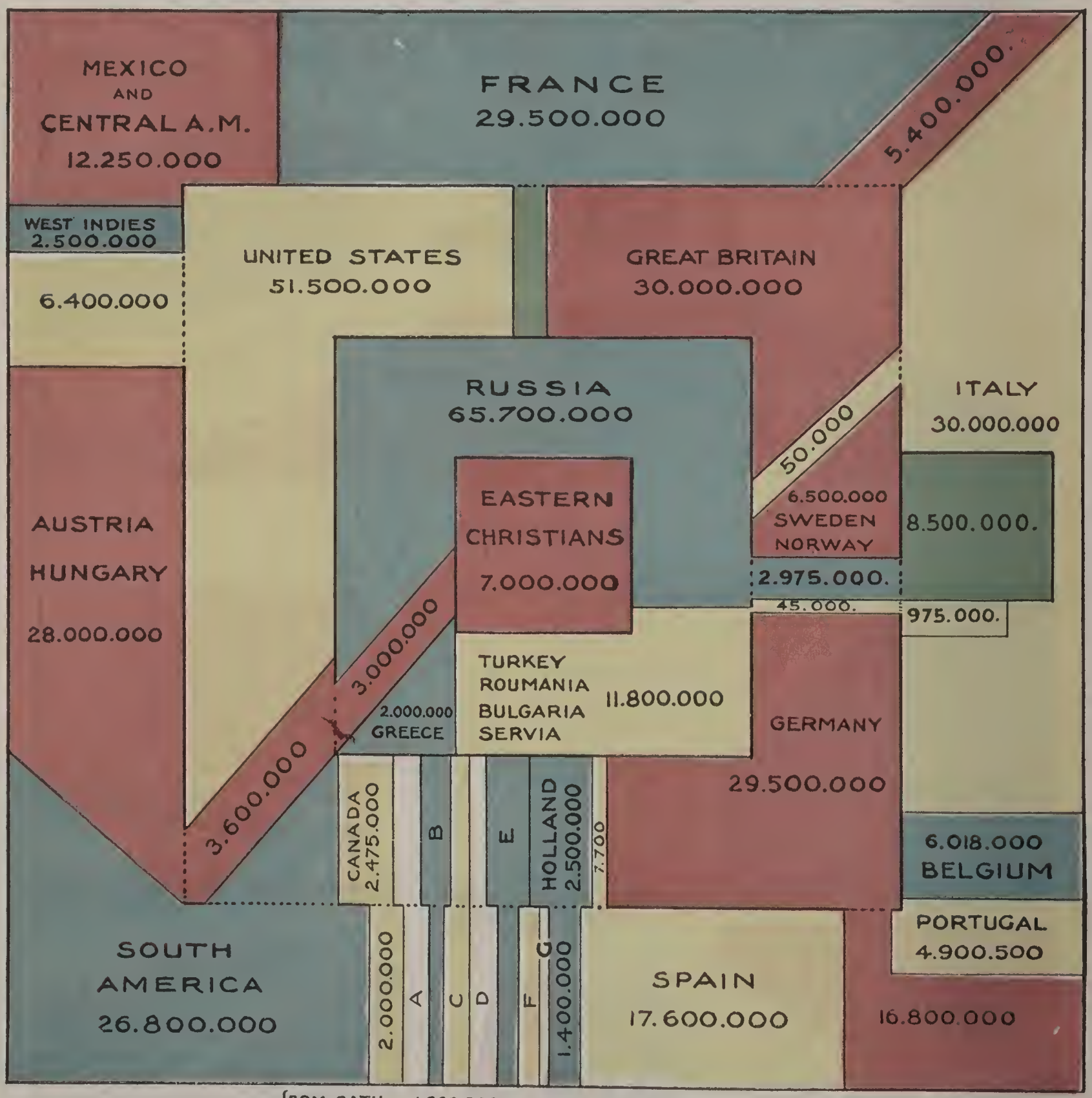


EXPORTS



PRINCIPAL RELIGIONS
DISTRIBUTION OF CHRISTIANS OF THE WORLD

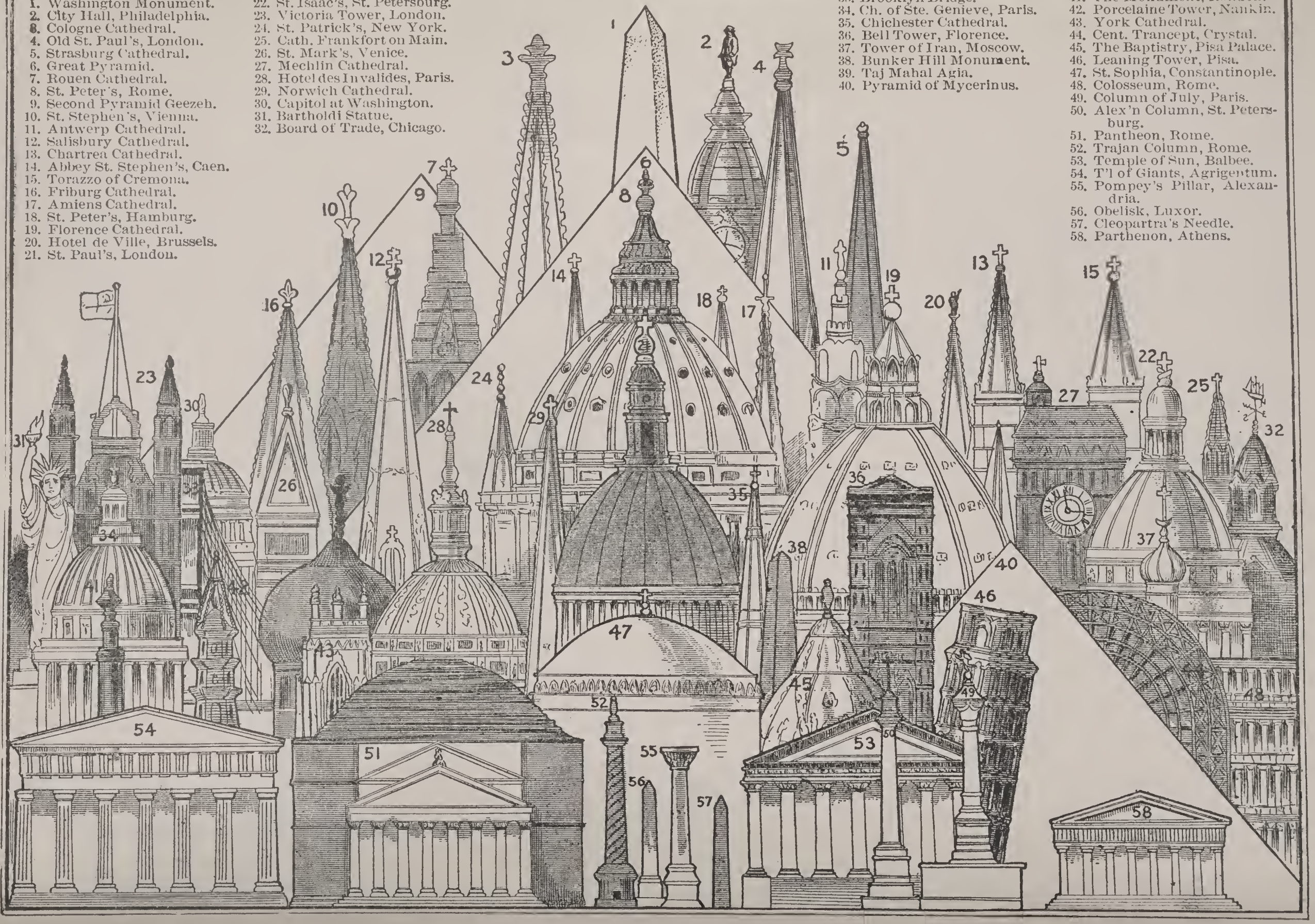
ROMAN CATHOLICS	200.000.000	JEWS	10.000.000
PROTESTANTS	150.000.000	MOHAMMEDANS	170.000.000
GREEK CHRISTIANS	90.000.000	HEATHENS	170.000 000
		PAGAN RELIGIONS	700.000.000



a- AFRICA	ROM. CATH.	1.200.000	d- INDIA & CEYLON	ROM. CATH.	1.700.000
	PROT.	900.000		PROT.	500.000
b- AUSTRALIA & POLYNESIA	ROM. CATH.	500.000	e- SWITZERLAND	ROM. CATH.	1.195.000
	PROT.	1.200.000		PROT.	1.900.000
c- ARCH., ARABIA & PERSIA	ROM. CATH.	1.000.000	f- CHINA & JAPAN	ROM. CATH.	850.000
	PROT.	95.000	g- LUXEMBURG	ROM. CATH.	225.000

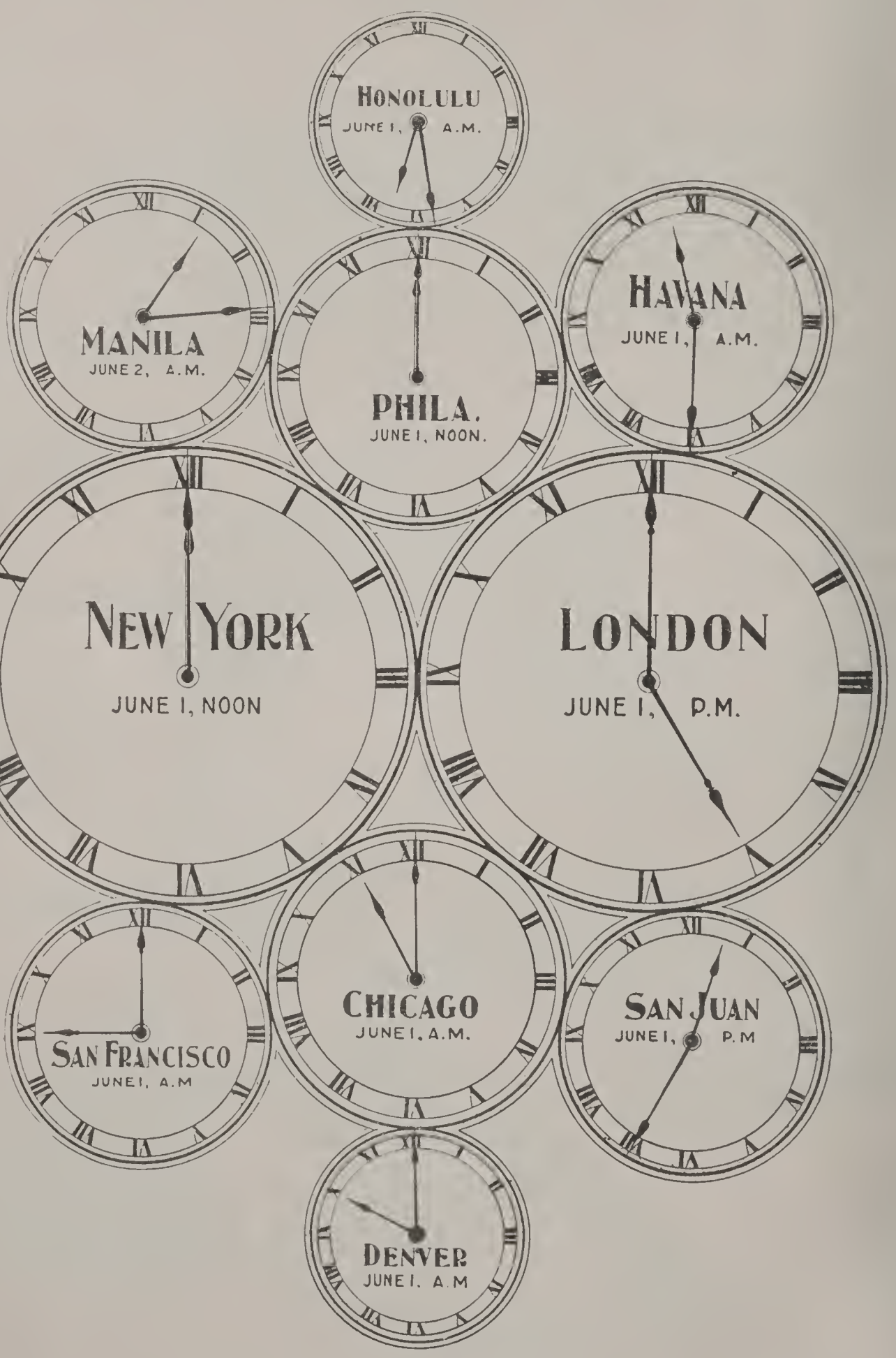
OUTER SQUARE--ROMAN CATHOLICS. SECOND SQUARE—PROTESTANTS.
THIRD SQUARE—GREEK CHRISTIANS.

1. Washington Monument.
2. City Hall, Philadelphia.
3. Cologne Cathedral.
4. Old St. Paul's, London.
5. Strasburg Cathedral.
6. Great Pyramid.
7. Rouen Cathedral.
8. St. Peter's, Rome.
9. Second Pyramid Geezeh.
10. St. Stephen's, Vienna.
11. Antwerp Cathedral.
12. Salisbury Cathedral.
13. Chartrea Cathedral.
14. Abbey St. Stephen's, Caen.
15. Torazzo of Cremona.
16. Friburg Cathedral.
17. Amiens Cathedral.
18. St. Peter's, Hamburg.
19. Florence Cathedral.
20. Hotel de Ville, Brussels.
21. St. Paul's, London.
22. St. Isaac's, St. Petersburg.
23. Victoria Tower, London.
24. St. Patrick's, New York.
25. Cath. Frankfort on Main.
26. St. Mark's, Venice.
27. Mechlin Cathedral.
28. Hotel des Invalides, Paris.
29. Norwich Cathedral.
30. Capitol at Washington.
31. Bartholdi Statue.
32. Board of Trade, Chicago.
33. Brooklyn Bridge.
34. Ch. of Ste. Genieve, Paris.
35. Chichester Cathedral.
36. Bell Tower, Florence.
37. Tower of Iran, Moscow.
38. Bunker Hill Monument.
39. Taj Mahal Agia.
40. Pyramid of Mycerinus.
41. The Monument, London.
42. Porcelaine Tower, Nankin.
43. York Cathedral.
44. Cent. Trancept, Crystal.
45. The Baptistry, Pisa Palace.
46. Leaning Tower, Pisa.
47. St. Sophia, Constantinople.
48. Colosseum, Rome.
49. Column of July, Paris.
50. Alex'n Column, St. Petersburg.
51. Pantheon, Rome.
52. Trajan Column, Rome.
53. Temple of Sun, Balbee.
54. T'l of Giants, Agrigentum.
55. Pompey's Pillar, Alexandria.
56. Obelisk, Luxor.
57. Cleopartra's Needle.
58. Parthenon, Athens.



THE HIGHEST STRUCTURES IN THE WORLD.

DIFFERENCE IN TIME BETWEEN NEW YORK AND OTHER PARTS OF THE WORLD



LIQUID AIR.

THE COLDEST SUBSTANCE KNOWN TO MAN. THE MOST MARVELOUS DISCOVERY IN THE REALM OF SCIENCE.

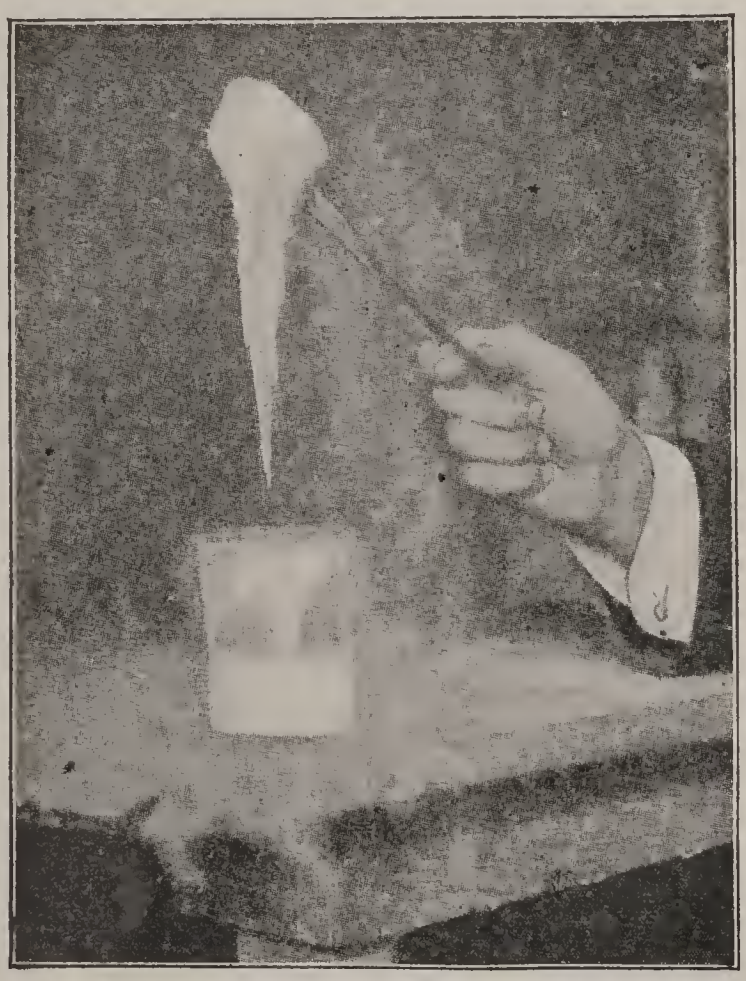
ONE of the most interesting discoveries in the realm of science in late years has been that of liquid air. It was long ago observed that when a gas was compressed so as greatly to reduce its volume, it became hot. This was called the heat of compression, and, strangely enough, was thought to be generated by the act of compression. It is now understood, however, that the rise in temperature is not caused by an increase in heat, but rather by the concentration of the manifest heat of a large volume into a small space. Experiments that proved this also suggested that the discovery could be turned to profit by cooling the heated gas down while under pressure, and then allowing it again to expand to its original volume, which would make it fall greatly in temperature. It was soon learned that gas could be compressed and then cooled and allowed to expand until its temperature dropped 200 degrees.

For some time it had been held by scientists that air was a permanent gas, and could not be changed in its form, but gradually with experiments the idea arose that if air could be brought to a sufficiently low temperature it could be liquefied. All means known were used without success until, in 1877, *Raoul Pictet* submitted oxygen gas to an enormous pressure combined with intense cold. The result was a few drops of clear, bluish liquid that bubbled violently for a few moments, and then evaporated into the air again. In 1892, a Polander named Olzewski succeeded in performing a similar experiment with nitrogen, the other constituent of air. And about the same time Professor Dewar, of England, not only performed both of these experiments, but also succeeded in producing a small quantity of air in a mushy form—in fact, air-ice.

The Cost

of this first ounce of liquid air was more than $3,000. While being a very interesting discovery for laboratory use, such a production and at such an expense was out of the question for commercial purposes. So it remained for Charles E. Tripler, of New York City, to invent a method whereby this wonderful agent can be brought forth with ease and at the cost of about 20 cents a gallon. He saw at once, upon the discovery that air could be liquefied, that it might be a great power generator, and accordingly commenced experiments to simplify the method for procuring it. He investigated the various means by which refrigeration was developed, such as the immense ammonia plants used in breweries and the like. The principle of cooling by expansion, he learned, was the basis to work upon, and the result of his studies was the following system:

At present a fifty-horse power plant operating an air compressor, and a barrel-like arrangement about fifteen feet high, full of small pipes and valves, and protected by wrappings so as to keep out the heat, are the machines by means of which this new discovery is brought forth. Tripler uses compressed air to cool the other air that he is liquefying. Under the very principle that expanding air grows cooler, if he could so arrange his



ALCOHOL FROZEN IN A GLASS OF LIQUID AIR.

apparatus that air which was rapidly growing cooler could pass about pipes containing his working material, he would have his problem solved. And so it is.

Air under a pressure of 2,500 pounds to the square inch, and cooled to about 50 degrees Fahrenheit by being passed in pipes through a bath of running water while thus compressed, is carried through coils of pipe to the large felt-and-canvas-covered tube or receiver spoken of. Two sets of pipes lead from the compressor to the receiver: one contains the air to be liquefied, the other the air that does the work of liquefying, but both are under the same heavy pressure. By turning a tap in the receiver, the air that does the work rushes forth and up the sides and around the pipes in the chimney-like space of the receiver. This reduces the pressure, and since air in expanding takes up heat wherever it can be found, the air confined in the pipes is cooled. As the released air now grows warmer and climbs to the top of the receiver, it gradually returns to the compressor. Here it is again brought under pressure and cooled again, only to be released once more in the receiver to lick up more warmth from the air in the pipes. Since the temperature of the air under treatment is going down in jumps of 100 degrees every time it is treated to this chilling process, it takes but about fifteen minutes till a tap at the bottom may be turned, and drops of liquid air at the temperature of 312 degrees below zero drip out from the pipes in the receiver. These at once evaporate in great billowy clouds of vapor.

But it is not intended that such an operation shall be devoid of results, so devices have been invented for holding the air after its production. One of these receptacles is the

Dewar Bulb.

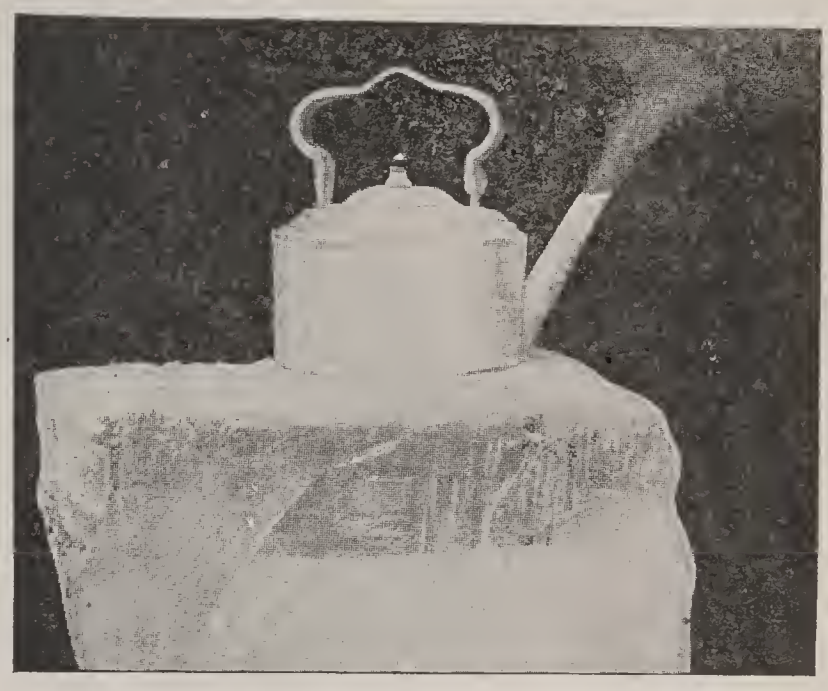
It consists of two vessels of glass, one within the other, having a high vacuum between the walls, and joined in a common neck at the top. The vacuum prevents the passage of heat, so that the evaporation of the liquid in the inner tube is reduced to a minimum. The neck of the bulb is left open, for liquid air is of such an expanding nature that it would otherwise explode. The cold, heavy mist of evaporation that is always present at the mouth of the bulb acts, however, as a

shield to some extent. Lately, Dewar tried putting a few drops of mercury between the walls of the two bottles, with the result that in a vacuum the mercury vaporized and spread itself over the walls of the bottles. This acted as a mirror, and still more effectually kept out the heat. Tripler has arranged a set of cans of similar nature, which are covered with felt and canvas so that the liquid air may be shipped. The mouth of the can is also covered with felt, but this is safe, as it allows the gases to escape somewhat. Air thus packed loses less than one-third in a nine hours' ride.

The Uses and Experiments

to which this wonderful discovery may be placed are as odd and interesting as the method of its production. The following are a few of its uses:

It is eleven and one-half times as powerful as compressed air, and may be carried in a pasteboard box, while as much energy in compressed air would need the strongest steel cans. It may supplant some forms of fuel, for, when mixed with any form of carbon, it burns rapidly or explodes. Thus it may be used in interior combustion engines—for instance, the gas engine. When a proper motor has been developed, it will no doubt be used to help solve the question of aërial navigation, for something that combines great power with lightness seems to be the only reason why air-ships are not a complete reality. The same may be said of submarine navigation. Here liquid air would supply the motive power, and the air for the crew to breathe as well, for a small quantity contains as much air as can be compressed into many great tanks. An automobile is now being made to run by this power. Deep-sea diving would also be aided by the use of casks of this air attached to the diving apparatus of the diver, thus doing away in a great measure with the pumps. In mines where water is likely to rush in at any time, it might be used to freeze the surrounding earth, thus preventing great catastrophes. In making such vacuum bulbs as those used for electric lights, liquid air would be very useful. After the air has been pumped out as much as possible, the remainder can be frozen into a solid drop at one



LIQUID AIR BOILING ON A BLOCK OF ICE.

The temperature of Liquid Air being 312° below zero and the Ice 32° above, the latter is like a furnace in comparison.

end, and then the bulb may be closed above it by an ordinary blow-pipe, thus giving an absolute vacuum. The most frightful explosives can be produced with the combination of combustibles and liquid air, for oxygen is necessary to combustion, and this air contains it in vast quantities. Of late months, physicians and surgeons are singing the praises of this discovery, for by its aid a wound may be cauterized, or an excrescence "burned" away entirely. Odd experiments, such as freezing a rose in all its color and loveliness, or reducing an egg to a frozen solid that when handled will break up into a thousand fragments and the yolk scatter as the pollen of a flower, show what may be done in the laboratory



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PROF. CHARLES E. TRIPLER

HE IS TO LIQUID AIR WHAT EDISON IS TO ELECTRICITY. THIS NEW AND GREAT DISCOVERY IS DESTINED TO REVOLUTIONIZE EVERYTHING PERTAINING TO THE SUPPLY OF MOTIVE POWER FOR TRANSPORTATION, MACHINERY, REFRIGERATION, MANUFACTURE OF POWERFUL EXPLOSIVES, ETC. THE ABOVE ILLUSTRATION SHOWS A HAMMER OF FROZEN MERCURY.

THE HORSELESS AGE.

AUTOMOBILES, MOTO-CARS AND OTHER AUTOMATIC VEHICLES.

The speed of an average railroad train made possible, with only good roads and clear right of way necessary. A vehicle that is destined to take the place, to a great extent, of horses, electric and cable cars, and cheapen as well as add comfort to conveyances.

THOUGH the manufacture and use of self-propelling vehicles are yet in their infancy, the industry is growing to such an enormous size that it is taking in half the carriage and wagon factories in this country. For many years attempts have been made to solve the problem of propelling wagons, carriages and other vehicles along the highways without the use of rails to run upon, and by some such motive power as steam, compressed air or electricity. Five years ago a few very expensive locomotive-like affairs had been turned out that operated with great fuss and feather, but were successful to the extent that large manufacturers employed skilled inventors to work out new ideas. Now we have the industry growing to great size, and such self-moving cars, wagons, trucks and carriages being used universally in the large cities, with the prospect of their invading the realm of the horse in the country before many years.

France at present leads in the use of these contrivances, and has a fashionable automobile club numbering 1,700. Recently an exposition was held in which 1,100 vehicles were shown, representing every sort and kind from a fashionable brougham to a milk-peddler's cart. The motive power in most of these machines is gasoline or naphtha, while those England has been putting out run mostly by steam. It has been left to America, as in most other things, to bring forth the perfect electric carriage. And this latter kind seems to give better satisfaction than any other, by reason of its safety, endurance and speed, extensive orders from Europe being proof of acceptance of the American models abroad.

To be worthy of consideration, the modern motor vehicle, no matter what its method of propulsion, should be odorless, almost noiseless, and free from jolting. Methods that are likely to result in explosions are being cast aside, and the weight of the motor, which is at present rather great, is being reduced as much as possible. Most of the carriages look odd to one seeing them for the first time, for, having no shafts or poles, they appear "bobbed" off in front. They are also rather too high for self-propelled vehicles, but soon they will have more graceful outlines and by having smaller wheels and less gearing the body of the vehicle will be nearer the ground. Of course, when a horse was attached to draw the wagon, it

was necessary that the wheels be high enough so that the rider could see over the horse's back. And when these new methods for travel were first attempted, the carriage as it had been was made

have been applied with success; the others are in their infancy, while the new power generator, liquid air, is expected to bring forth great power ere long, in a compact and very light form. The



Courtesy of Woods Motor Vehicle Co.

AN ELECTRIC AUTOMOBILE ON ONE OF OUR CITY STREETS.

use of without much change in appearance.

In America, altogether there are six motive powers employed: electricity, steam, gasoline, compressed air, carbonic-acid gas and alcohol. The first three

Electric Mobile

is the one in most common use in this country, and possibly has the combined qualities of being more rapid, cleaner, and more nearly "fool-proof" than any other. The method employed for its con

struction is similar to that used on any electrically-driven apparatus: namely, a strong motor attached to the wheels, and propelled by electricity from storage batteries carried on the vehicle. Such a motor is odorless, almost without vibration, and is practically noiseless. It can run with great speed and climb almost any hill road so long as it is smooth. Of course, it is very heavy, owing to the use of storage batteries, and it can run only a certain distance without being recharged with electricity. These batteries weigh from 500 to 1,500 pounds each, the vehicle weighing from 900 to 4,000 pounds. An ordinary lady's phaeton weighs about a ton, and carries a battery of 900 pounds. When the battery is empty it may be recharged again at electrical stations maintained for the purpose, after which the carriage is ready for its journey once more. The current not only operates the motor at the wheels, but also lights the lamps, rings the alarm gong, and, in cabs, actuates a push-button bell for communication between the passenger and driver.

Aside from the device for supplying power to the wheels, there are numerous others for guiding and controlling the machine when it is under way. Near the seat of the driver are a number of switches and levers, which to one just learning how they operate are rather bewildering. In fact, schools are maintained where persons are taught how to manage these roadsters. In France a special highway is prepared with dummy figures in the path where the beginner is learning, the object being to become so proficient that none will be knocked down by the carriage running away. The driver must keep his eyes wide open and both his feet and hands busy. With his left hand he grasps the power lever which controls the speed, while with the right he manages the steering lever. He has one heel all the time on an emergency switch that cuts off the current, and at the same time must ring a gong to warn people of the approach of his pneumatic-tired conveyance. With the other foot he manages a reversing-switch that will back the carriage, while with his toes he applies a quick brake. When he wishes to turn on the lights he presses a button under the seat. So it may be seen that he is rather busy, and can never go to sleep and let the old horse carry him home.

In all the large cities lines of these electric cabs are being established. Most of them run from twenty to thirty miles without new current. It is a simple matter to recharge

The Storage Batteries,

it being necessary only to put in a plug connecting it with the generator, somewhat after the fashion of a bicycle pump. This may be done at almost any electrical plant, and in some places, Belgium for instance, regular posting stations are being established, while coin-in-the-slot "pumps" will soon be arranged on the corners of city streets where a broken-down battery may be refilled.

The gasoline motors are in some ways inferior to those run by electricity; though all the long-distance races in Europe have been made in vehicles thus propelled This motor is lighter than the other kind and needs no recharging station, gasoline being procurable at any crossroads at a small price. On the other hand, these engines are not self-starting, a push on the piston rod being necessary, and then the carriage throbs under the motion of the machinery. The ins and outs of all the machinery must be thoroughly learned, and one really becomes an experienced engineer before he masters the art of guiding this sort of automobile. When one has learned, how



DIFFERENT STYLES OF AUTOMOBILES PASSING IN REVIEW, SHOWING THE DESIGNS BUILT BY THE WOODS MOTOR VEHICLE CO., CHICAGO.

ever, he is master of the situation, for he may travel up to fifty miles an hour on smooth roads, and through mud and other difficulties at less speed, with the aid only of a can of gasoline

The process of

Power Generation by Gasoline

is very simple. It is known that this liquid mixed with certain quantities of air and confined will, when ignited, explode with violence. A cylinder is devised which admits this combination at one end, the gas is exploded at the proper time and drives out the piston rod, which in turn causes the fly-wheel to revolve, drawing the piston back to its old place once more, after which the operation is repeated. Most of these engines operate under four cycles or impulses. During the first the vapor is drawn into the cylinder during the second it is compressed by the return piston; during the third it is exploded, and in the fourth the products of the explosion are driven out, and the cylinder is ready for the new charge. In most engines the explosion is caused by an electric spark, there being no fire on the vehicle. Owing to the heat generated by the explosions going on all the time, the machinery must be kept cool by being cased in water jackets



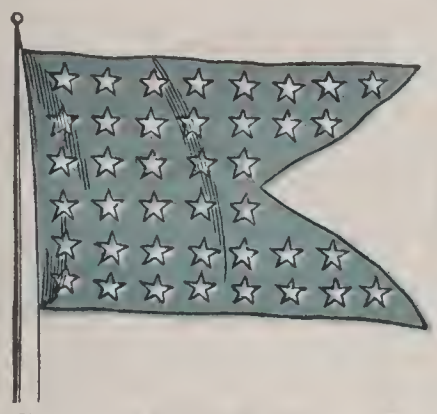
UNITED STATES.



UNION JACK.



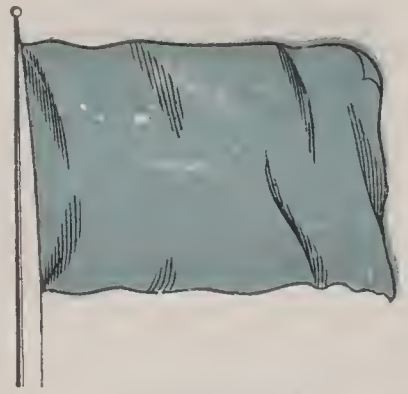
U. S. REVENUE.



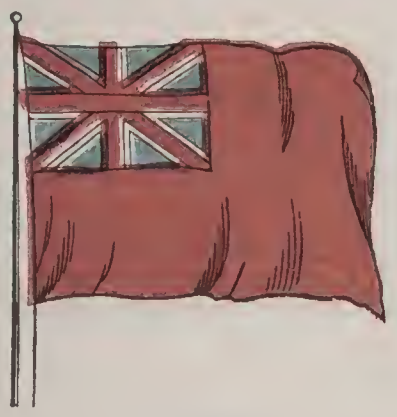
U. S. COMMODORE PENNANT.



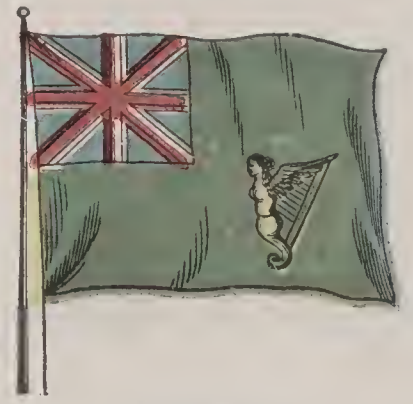
U. S. YACHT.



U. S. ADMIRAL.



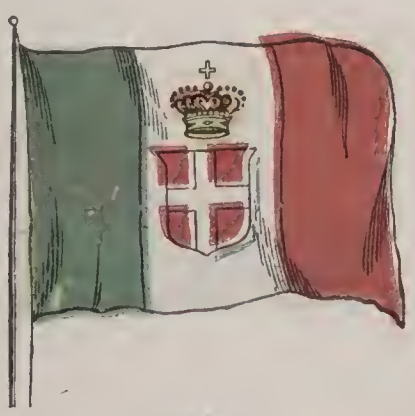
ENGLAND.



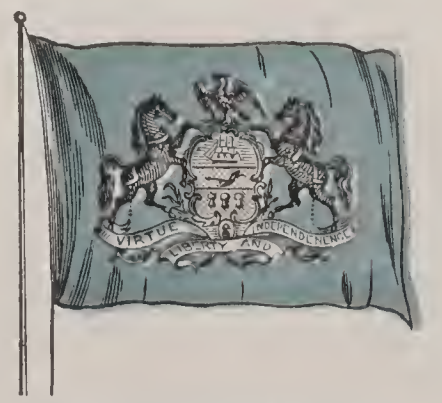
IRELAND.



GERMANY.



ITALY.



PENNSYLVANIA STATE.



GERMAN MERCHANT.

FLAGS OF ALL NATIONS.



GREECE.



INDIA.



PERU.



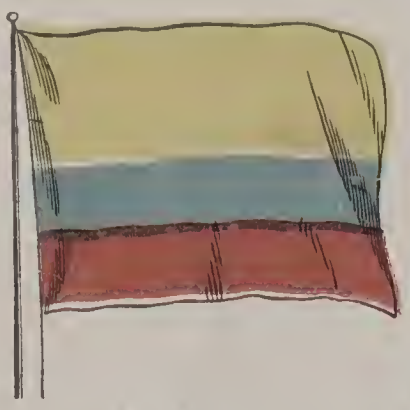
VENEZUELA.



TURKEY.



PARAGUAY.



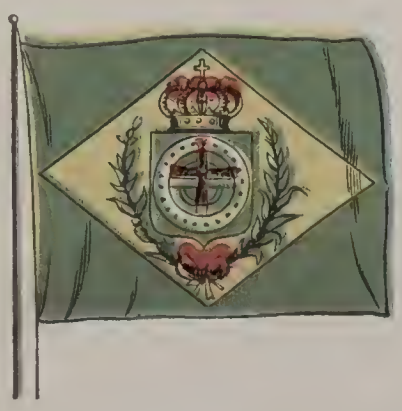
ECUADOR.



DENMARK.



RUSSIA.



BRAZIL.



HANOVER.



BOLIVIA.

FLAGS OF ALL NATIONS.



FRANCE.



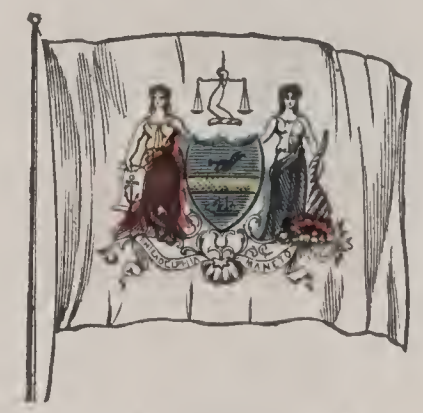
ARGENTINE REPUBLIC.



SANDWICH ISLANDS.



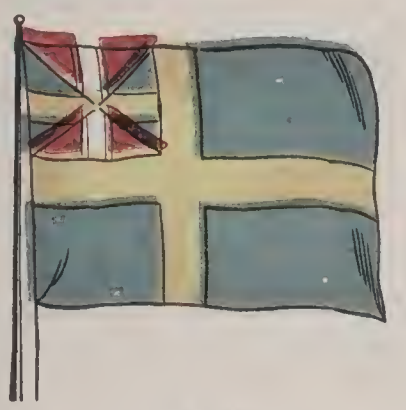
JAPAN.



PHILADELPHIA CITY.



HOLLAND.



SWEDEN.



LIBERIA.



AUSTRIA.



BELGIUM.



MEXICO.



EGYPT.

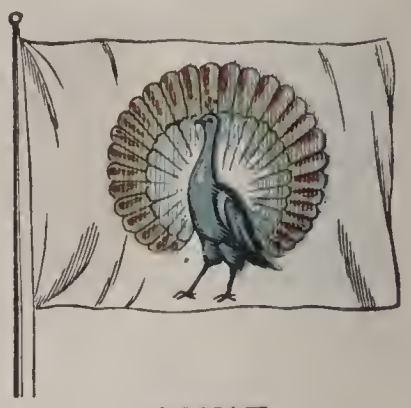
FLAGS OF ALL NATIONS.



SWITZERLAND.



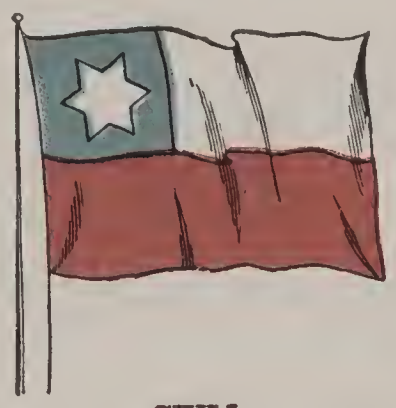
CHINA.



BURMAH.



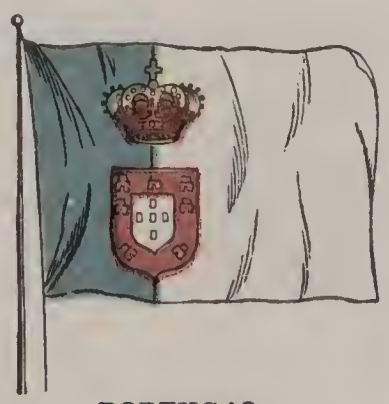
NORWAY.



CHILI.



SPAIN.



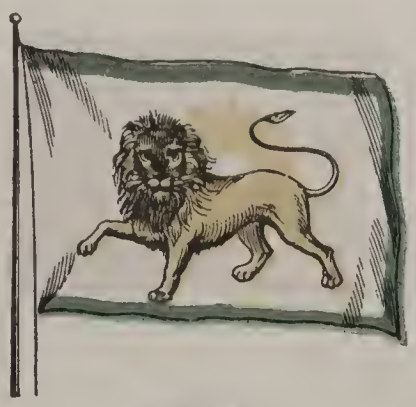
PORTUGAL.



URUGUAY.



SIAM.



PERSIA.



HAYTI.



NEW GRANADA.

FLAGS OF ALL NATIONS.

some cases the spark is done away with by having the compression of the gasoline so great that it explodes of its own heat. Different devices are made for mixing the proper quantities of gasoline and air, and many improvements are going on in general to do away with odors, vibrations and the like.

The cost of owning and operating automobiles for a period of several years is really considerably less than that of horses and carriage, and especially is this true of the gasoline kind. Many of the gasoline vehicles will run 100 miles on a half-dollar's worth of liquid.

Steam engines have been used to some extent for both trucks and pleasure vehicles with success. For the latter, however, they are not as yet in the stage where they are desirable, there being a great deal of complicated machinery to run which requires a regularly licensed engineer; and then there is generally a puffing sound and escaping steam at the exhaust pipe. However, for traction engines, trucks, fire-engines and omnibuses, they have proved eminently successful, because of the ease with which fuel and water may be had. As yet,

Compressed Air

is rather cumbersome to handle. One truck has been constructed which has a set of cylinders operated by this method somewhat after the style of steam. The compressed air is held in huge steel storage bottles or tubes, which are carried under the wagon. Difficulty has been had from the freezing of the valves when the air is turned on and escapes rapidly. This is because of the great reduction of the temperature about the pipes when the air expands and sucks up latent heat. To avoid this a system of hot-water pipes heated by a gasoline flame is arranged, that keeps the valves from cooling too much. Because of the great weight of these trucks they are as yet not much used. However, improvements are being made daily. One inventor has arranged a small gasoline engine that generates electricity in the front of a truck and stores it in batteries at the back. From these storage batteries the current is drawn which runs an electrical motor. This truck weighs, however, over 9,000 pounds, and when loaded about 25,000 pounds, making it a serious question for good pavements.

The Uses

to which automobiles are being put are numerous and varied. All sorts of pleasure vehicles are already in use, together with cab and omnibus lines in competition with street-car lines. A railway hand-car has recently been put in use, of the gasoline velocipede type, capable of carrying three persons at the rate of thirty-two miles an hour. The Parisian fire department uses an electric automobile the battery of which is only one-fifth the weight of the whole apparatus including the crew. It is capable of traveling four or five hours at the rate of twelve miles an hour. In other fire departments many of the light buggies of the chiefs and marshals are driven by electricity, and run from forty to fifty miles per day. The post offices of several of the larger cities are now using autowagons for delivering and picking up mail, while nearly all the great department stores use electric wagons exclusively in their delivery business. The War Department at Washington has recently taken official cognizance of the automobile by ordering several wagons for the Signal Corps, and soon it is expected ambulance and ammunition wagons will be ordered of the same kind.

It may readily be imagined what will be

the outcome of these marvelous strides in perfecting self-propelling vehicles. It means better pavements and roads all over the country, and in the city before long the noises from the harsh rumbling of wheels and the crash of the horses' hoofs will be replaced by the rapid swish of the pneumatic tires.

Already capital to the amount of $400,000,000 has been invested in the manufacture of these vehicles in New York, Chicago, Boston and Philadelphia. Laws have become necessary for their regulation. In France they must be licensed, and the driver must have a certificate of proficiency Speed must not exceed 18½ miles an hour in open country, or 12½ miles in passing houses, while in narrow thoroughfares it must be reduced to walking pace. All sorts of names are being proposed for this style of vehicle, from "horseless wagon" to "self-propeller" and "autocar." It seems, however, that the French "automobile" has come to stay.



Courtesy of the Woods Motor Vehicle Co.)

A TRIP INTO THE COUNTRY IN AN AUTOMOBILE OF THE ENGLISH TRAP DESIGN.

MARVELS OF THE RAILWAY.

GREAT WEBS OF STEEL BRIDGING VAST CONTINENTS,

Giving the North the fruits of the tropics fresh from the trees and vines, the South the grains and other products of the colder climes. Uniting the East and West by shortening the time, making travel a luxury and lessening expense.

DOWN to 1850 progress in railway building was very slow, but shortly after came a great "boom" in stocks, and the years succeeding 1865 were noted for their vast strides in railway improvements and construction. Seventy years ago there were not twenty-five miles of rail in the whole country; to-day the total mileage of the United States is nearly 200,000. This is about half the number of miles in the whole world.

In 1850 nearly all the roads were confined to the North Atlantic States, but in the next decade a number of lines were pushed west to the Mississippi, and shortly after came the first great transcontinental system to the Pacific. The railroads built in the west were necessarily forerunners of civilization, and where the engine had to go under armed guard to keep off the attacks of the Indians, it was not to be expected that construction would be other than cheap. Towns did not have to be consulted as to rights-of-way, for towns followed rather than preceded the railroad. As years went on, however, this cheap method of building was thrown out for new and modern improvements, and to-day every-



(Courtesy of C., B. & Q. Ry.)

MODERN A LA CARTE DINING CAR.

where old wooden culverts are being replaced by steel bridges, secure rock ballast is taking the place of the bedding that was formerly so easily washed out, and heavy and continuous steel rails now form even and smooth tracks, instead of the old warped iron affairs. Curves have been straightened, steep and dangerous grades have been abandoned for cuts and tunnels, and instead of the murderous grade-crossings we are now being supplied with elevated systems and block signals. All this takes enormous wealth, but the roads are constantly increasing in that direction. It is true that many improvements are yet to be expected, even with our "lightning flyers," ere travel will become perfect, but these improvements will be along the lines of the already existing roads, rather than along new lines yet to be laid out.

If construction in the number of miles laid out has been great, even greater has been the development in the

Luxury and Ease of Traveling.

Some forty years ago the continuous steel rail had not been invented, and the link-connected cars clattered along over the disjointed rails with a rattle and bang that was nerve destroying. The only conveniences then provided for, even on the "through trains" across the country, were a few telegraph blanks, a separate smoking apartment, and, in some cases, a buffet from which were served food and drink of poor quality and enormous price. The night train was a thing unheard of and the Pullman sleeper had not yet made its appearance. To-day one journeying from coast to coast need hardly give a thought as to his comforts after he has boarded the modern cross-country "flyer." Trains are now really almost smooth-running, and are equipped with every device for comfort that man can imagine. Drawing-room, observation, dining, and sleeping cars arranged with an eye to artistic effect as well as to luxurious comfort, are ever being improved upon by the companies, while electric and gas lights, vestibules between cars to keep out noise and dust, barber shops, buffet smoking cars, card rooms, and libraries and music rooms, with waiters and porters at every turn, are daily adding to the ease of travel, as well as to the pocketbooks of the railway magnates.



(By Courtesy of the "Burlington Route.")

A GENTLEMEN'S CLUB ON WHEELS.

Interior view of a modern buffet and smoking car.

New Construction.

To think, then, that all these devices will soon be applied to trains of cars running regularly across every continent on the globe is to wonder what will be the limit of man's power. To-day there are in course of construction two marvelous lines: one, the Trans-Siberian route, being laid by the Russian government from St. Petersburg, Russia, to Port Arthur, China, thus taking in all the resources of unknown Siberia and China; running along the gulf coast to Guatemala, then along the border and down through the South American states to the Pacific coast, thus making a thread line from North to South America.

Trans-Siberian and Chinese Eastern Railways.

Had Russia imagined in 1867 that she could ever have accomplished such a work of engineering skill as that of the construction of the Trans-Siberian and the Chinese Eastern Railways, she never



A MAP OF THE TRANS-SIBERIAN AND CHINESE EASTERN RAILWAY,

Showing the entire route from Port Arthur to St. Petersburg. The dotted line marks the course where work is not yet completed.

the other, the "Cape to Cairo" route, as yet only partly built and partly on paper, but a marvel in imagination, extending from the Cape of Good Hope, at the most southern extremity of Africa, up through unknown savage lands to its northern terminal at the old capital of the Pharaohs, Cairo, Egypt. Besides these two great undertakings, there is one of similar nature being promoted by American capital that is to be called the Intercontinental Railway, or the Pan-American Road. At the expense of $25,000,000 it is to connect this country with the South American states, starting from Matamoras, on the Rio Grande border, would have sold to the United States for the paltry sum of of $7,000,000 the great territory of Alaska. Instead she would have been our neighbor, with a seaport at Fort Wrangell, almost at our doors on Puget Sound, and England, with ever-watchful eyes, would turn from Russia at the gate of Herat to Russia within a day's march of Vancouver. But the first work of building this great thread across a continent full of superstitious semi-savages was not commenced till May 30, 1891, when the present Emperor, then Czarovitch, on his way around the world, visited Vladivostok and drove the first spike. It was then thought that the

Trans-Siberian could not be completed till 1905 or 1907. That was before the Chino-Japanese War, and a route had already been mapped out along the southern border of Siberia to Vladivostok, a port on the Pacific just north of Korea that is ice-bound all winter. This port was practically the only outlet for Russia on the Pacific, and accordingly great outlay was made for piers, ice-breakers, etc. But after Russia's aid to the Chinese in the war with Japan, China felt very grateful, and as a mark of esteem gave her benefactor great privileges in Manchuria, among which were the rights to build the Chinese Eastern Railway and to lease Port Arthur as its eastern terminus. This port is open the year round, so Russia at once gave up her other surveys along the Amur River, and instead began to throw out a line of roads to the southeast through the most fertile part of China, to end at Port Arthur, and with branches to Pekin and Vladivostok.

The Trans-Siberian Road

itself is practically complete, and after an expenditure of $150,000,000 has a through line from Irkutsk, on Lake Baikal, extending 4,000 miles to St. Petersburg. Across the lake to Missoyaga trains are being carried on great steel barges or ferryboats. Beyond this point the road runs in more or less complete state in an easterly direction to Stretinsk, and from the port at Vladivostok directly northward to Khabarovka. The country lying between this latter point and Stretinsk was to have been covered by a line that would have directly connected St. Petersburg with Vladivostok. But with the donation from China, as said before, this line was abandoned, and now the eastern terminus of the Trans-Siberian route is at Stretinsk, while a little to the south and west of this point, at Kidalova, the main Russian line is tapped by the Chinese Eastern Railway. The work across Siberia was full of difficulties, much of the land never having been traversed by white men before. Convict labor has been used to a great extent, thereby cutting down expense. Expense has not been spared in the least, however, to give good construction, and above all else is considered safety. Bridges that are marvels in civil engineering span numerous rivers between Stretinsk and St. Petersburg, twenty millions having been expended in this line alone. The largest and most costly of these is the great iron and stone affair that spans a distance of 3,150 feet over the Yenisei at Krasnoyarsk. It stands on five colossal circular stone piers, with matching stone abutments, and is thrown over the river in five spans. The cost was $2,300,000; the work was designed by Knorre, once a German, but now a naturalized Russian. Another great bridge, costing $2,000,000, extends over the Obi River at Kolivan. During the winter, when the rivers are deeply frozen, such parts of the road as yet have no bridges are strung temporarily across on the thick ice, and later are replaced by steel culverts.

The work of most interest at present, however, is that upon the

Chinese Eastern Railway.

which, though in direct conjunction with the Trans-Siberian road, is yet kept entirely separate in its finances and outward dealings with the public. In 1896 Russia contracted with China to build a road through Manchuria, guaranteeing that the president should be a Chinaman, and that at the end of eighty years the entire ownership of the road was to pass to China upon payment. The route was at once mapped out, and for rapidity of construction this line holds the record. The work

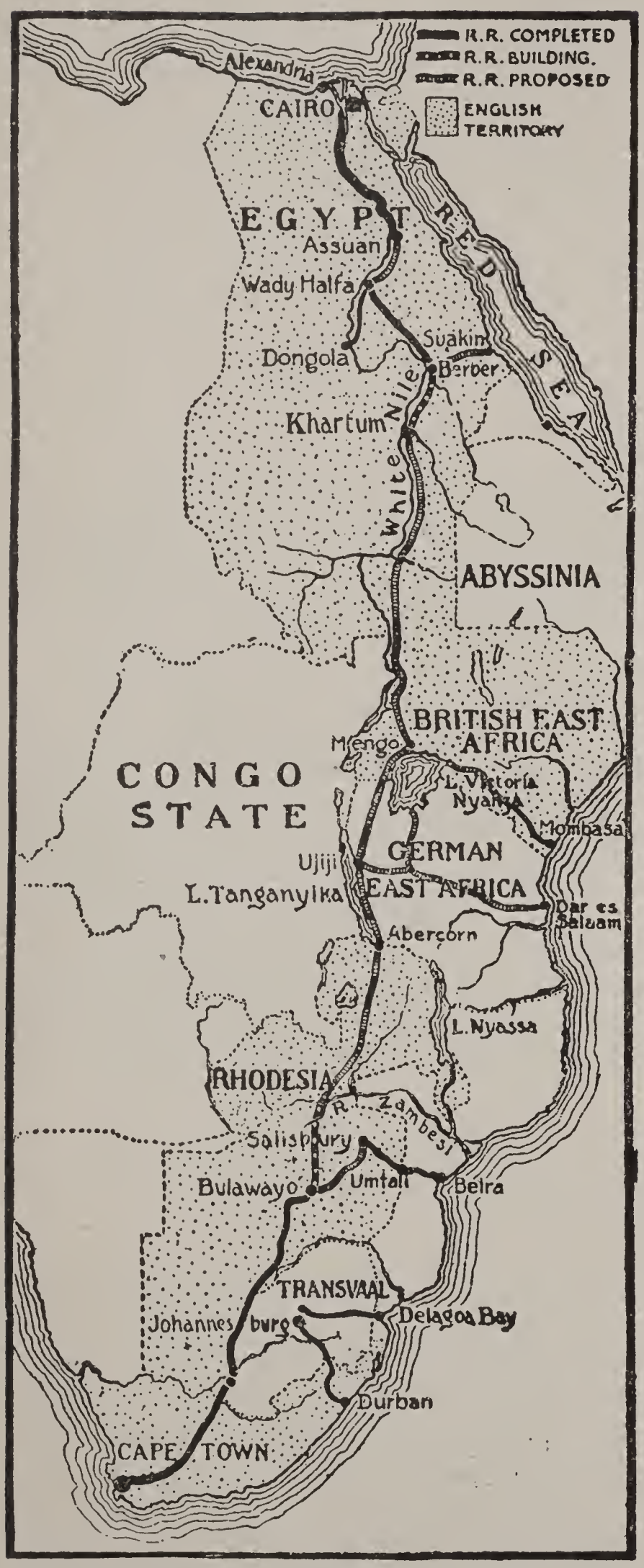
is being done by both Siberian convicts and Chinese coolies, while almost every tool and modern means of equipment is of American manufacture. The guards along the route are mainly Cossacks, and they dress half in Chinese and half in Russian costume. The flag of the company is likewise half of one country and half of the other. Of course, the enterprise is wholly Russian; and the result of this enterprise is startling. Cities have grown up all along the country that was formerly wilderness. To think of the wonderful civilizing effect of this railway is startling. The road covers like a hand 400,000 square miles of rich Chinese territory. The main line extends southwest from Kidalova to Vladivostok, while about midway it is tapped by a directly southern branch at a new town called Habin. From this point it runs to Port Arthur and to Pekin.



A CONVICT CAMP ON THE TRANS-SIBERIAN RAILWAY.

A Cossack guard is about to conduct a body of convict laborers to their daily task. This class of labor was largely used in the construction of the Trans-Siberian Railway.

Work on the new route is continued throughout the winter, aided by the use of American tools and supplies. European methods are in the main crude along engineering lines, and American enterprise supplies this work with nearly everything from steel for bridges to pick-axes and cross-ties. Rock drills caused a great deal of trouble, however, among the native Chinese and also to some extent among the convicts. It was impossible for these ignorant people to understand the workings of such an engine without visible motive power, and they at once came to the conclusion that the work was done by the white man's "slave devil." The result was that 10,000 workmen struck, and it was only with the greatest difficulty that they were induced to return to work. Eventually they became amused at the workings of the machines, though they still think them controlled by evil spirits. What has already been accomplished by the construction of such a great railway may be shown by noting that Habin, the junction of the two great railways, as well as headquarters of their officers, was not on the map at the close of 1899, and yet it is destined to be the Chicago of northern Asia. Already in this city are magnificent office buildings and dwellings, and broad and electrically lighted streets are to-day being paved in the most improved methods. Palatial



LATEST MAP OF THE ROUTE OF THE "CAPE TO CAIRO" RAILWAY,

Showing also southern countries now involved in war with Great Britain.

steamships arrive and depart daily, and machine shops, banks, ice-factories and other enterprises are numerous. To sum up the gigantic effort, a trip of 10,000 miles, or nearly half-way round the world, can soon be made without changing cars!

The Cape to Cairo Railway.

Were English capital being invested for the building of the Trans-Siberian and Chinese Eastern railways, we might see the value of the speculation, for it is only that nation that has colonies scattered all over the globe that will greatly benefit by easy means of communication between them. Russia, however, is not building these great distance-bridging webs of steel for the money there is in it; rather for the purpose of bringing her great domains together. But if Russia is outlaying millions of capital in a costly venture, England is risking still more in the scheme to build a railway throughout the length of Africa from the Cape of Good Hope to Cairo. Cecil Rhodes, the genius of South Africa, promulgated the idea, and though capital has been scarce for the purpose, yet the time is not more than ten years off when the most gigantic of all daring feats will have been completed. From point to point the distance to be covered is about 6,600 miles. Of this over 3,000 miles is already constructed, but the remaining portion, 3,200 miles, is yet to be strung across the most difficult stretches of land in all Africa. The total cost of the whole enterprise is estimated at $125,000,000, but as the northern and southern extremities are already laid, it will need only about $75,000,000 more.

And there really seems no reason for building this middle section now either. In the south from Cape Town to Bulawayo, and on the southeastern coast from Durban, Delagoa Bay, and Beira into the

interior where the lines have already been built, there was some reason for an outlay of capital, because of the great resources of the country, especially the gold and diamond fields. Likewise on the north it has been necessary to run lines to the south because of their value for the military in subduing the Mahdi. But from Khartum or Berber south along the White Nile and through the malarious lake regions, where the underbrush has yet no trail of the white man, it seems folly thus to put up a road over which there is no likelihood of traffic. At the best, the time of travel from Cape Town to Cairo and then by water to London, will take fourteen or fifteen days, at a heavy expense and with discomfort across the deserts, while the whole trip can now be made cheaply by steamer around the west coast of Africa in but two days more. However, the road is being built, and as such merits admiration.

The English government is not the pusher in this enterprise; whatever matures of the marvelous scheme will be due to the domineering pluck of

Cecil Rhodes.

When he first conceived the idea he figured on making a forerunner of a telegraph line. This had money in it, and though set upon by great obstacles, Rhodes has the line well under way and is endangering the revenues of the submarine cable lines to the Cape. The only place that he had great difficulty in securing right of way for the telegraph was through German East Africa. Here, for the privilege of running his own wires, he must also at his own expense run other wires for the German government, which they will keep up at his expense for forty years, and then they go to Germany without compensation.

From a point on the Zambesi River in Rhodesia it is planned to run the railroad north to Abercorn, then along Lake Tanganyika to Ujiji. From this point it will cross to Mengo in British East Africa, and then probably skirt the western edge of Abyssinia, avoiding as much as possible the malarious districts. Completed roads to Assuan in Egypt existed before the recent trouble with the Mahdi, and when General, now Lord, Kitchener, Sirdar of the Egyptian army, started from Wady Halfa towards Khartum, other lines were thrown out to transport the army and its supplies. As it is, completed lines now practically cover the district to Berber, and a road is being run to Khartum.

January 20, 1909, is set as the day for the laying of the last rail in this great stretch of track. This gigantic enterprise is likely to add greatly to the domain of Great Britain in that part of the world.

Ninety Miles an Hour

Speed on railway trains has been developed to at least ninety miles an hour between stops on level road. This has been done in actual work of carrying mails, and was the outcome of a race against time that took place January 1, 1899, on both the C., B. & Q. and the Northwestern railways on their respective lines running from Chicago to Omaha. With our new possessions in the Pacific Ocean any time saved on the way to the coast is of importance, and it was to secure mail contracts to these points that such speed was shown. It is no uncommon event to-day to travel at the rate of over fifty miles an hour, including stops, but extremely high rates of speed are not usually developed on passenger trains. When ninety miles are whizzing past in sixty minutes it taxes to the utmost the nerves of the engineer. All sorts of sights and noises are magnified in the night, and even if engines are improved

to fly at the rate of 150 miles an hour,—which it is said will before long be possible,—the driver of the engine would be able to run his train only a few years before he would be a physical wreck. With the improved headlights shadows are increased, and though the long stream of light aids in detecting breaks on the track at night, such a thing as a small fly traveling over the face of the lamp is enlarged to great size in a shadow on the track. The wind whizzes by, and when another train at an equal speed of ninety miles an hour from an opposite direction passes by, the two are coming together at the rate of 180 miles an hour. With all these strains, the engineer wishes to reduce rather than to increase the speed



(Courtesy of C. B. & Q. Ry.)

NINETY MILES AN HOUR.

"Burlington Route," Denver Limited Express Train.

Wireless Telegraphy.

MESSAGES SENT ACROSS SPACE, OVER WATER AND THROUGH MOUNTAINS WITHOUT THE AID OF WIRES.

Bridling one of the most delicate forces of nature, and making it do marvels in the service of man.

SINCE the perfection of the telegraph and telephone for commercial purposes, and the laying of cables across the ocean for the transmission of messages, electrical experts have been studying the problem of transmission of electrical energy for messages without wires. Gray devised a method of sending signals along light waves, and others tried transmitting telegrams to moving trains by means of the rails. These methods, however, were not successful in the main, and it was left for

M. Guiglielmo Marconi,

a Florentine yet in his twenties, to discover that Hertzian waves could be generated from electricity and sent across space without the means of intervening wires.

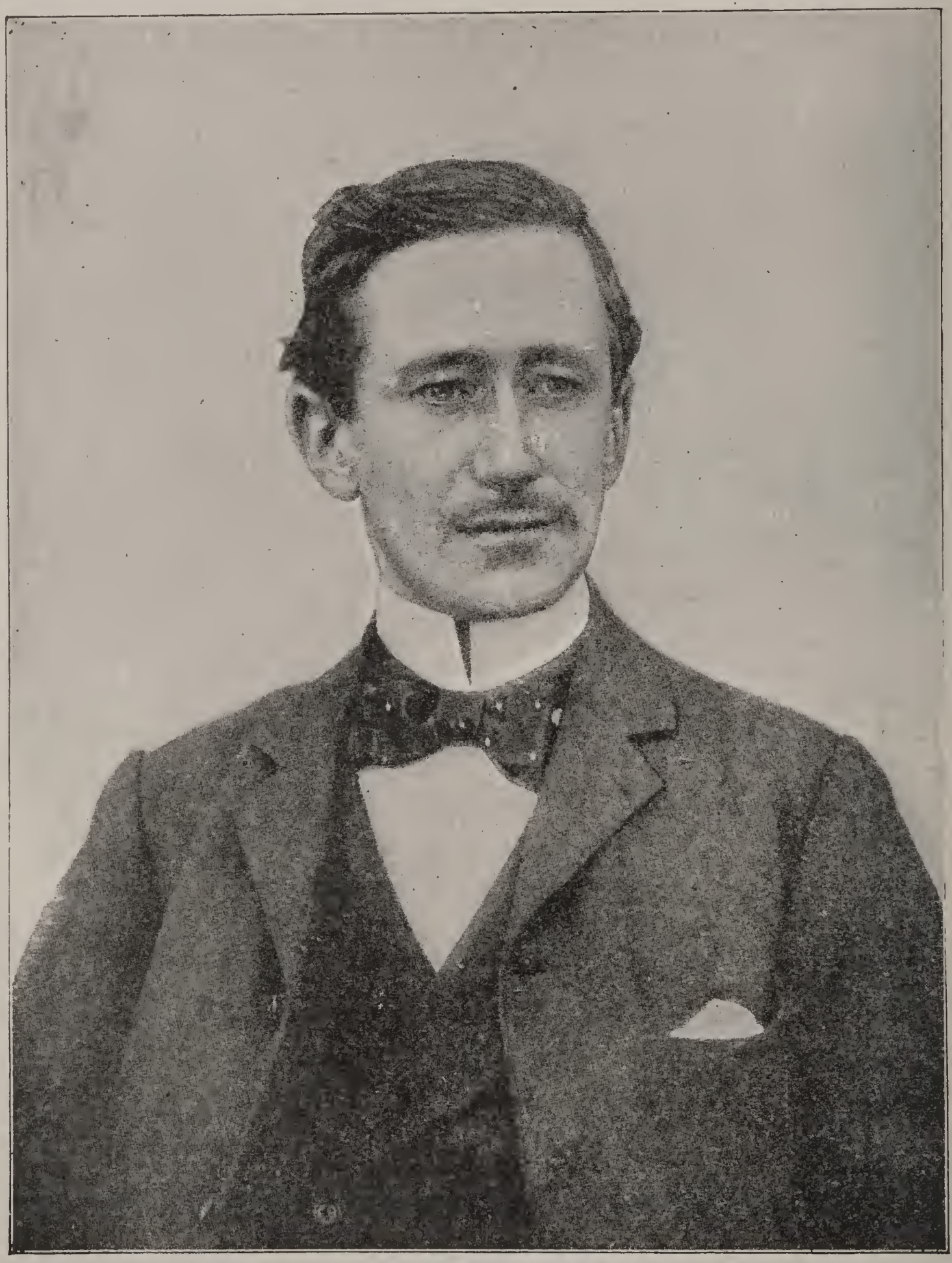
In 1895, while yet quite young, Marconi made experiments across his father's fields in Bologna, Italy, and by the use of tin boxes, called "capacities," set upon poles of varying height, and connected to separate instruments by insulated wires, he sent and received by a crude transmitter and receiver electrical signals without the aid of intervening wires. He soon learned that certain distances could be covered only by having the poles for his boxes of certain height, and the height of the poles had to be increased with the distance. He experimented with the aid of several other scientists for some time, and then the world was startled early in 1899 by the news that messages had been sent by this wireless method across the English Channel from Dover to Boulogne. Little had been known up to that time of the process, but enthusiasm was now expressed everywhere, and when, in October of the same year, the young wizard came across to America to report the great international yacht races between the Columbia and the Shamrock, for the New York papers, and succeeded so admirably that messages were flashed across space when both yachts and sending ship were enveloped by fogs and out of sight of land, it was manifest that another epoch-making discovery had been made.

The method employed by Marconi seems quite simple when it is known.

Hertzian Waves

are strange undulations generated by electric impulse that travel through the atmosphere and have the peculiar property of jumping from the Marconi transmitter and fleeing through space at the speed of light, or seven times around the

earth in a second. When Marconi understood that these beams could be sent and received by his first crude method, he at



M. GUIGLIELMO MARCONI,

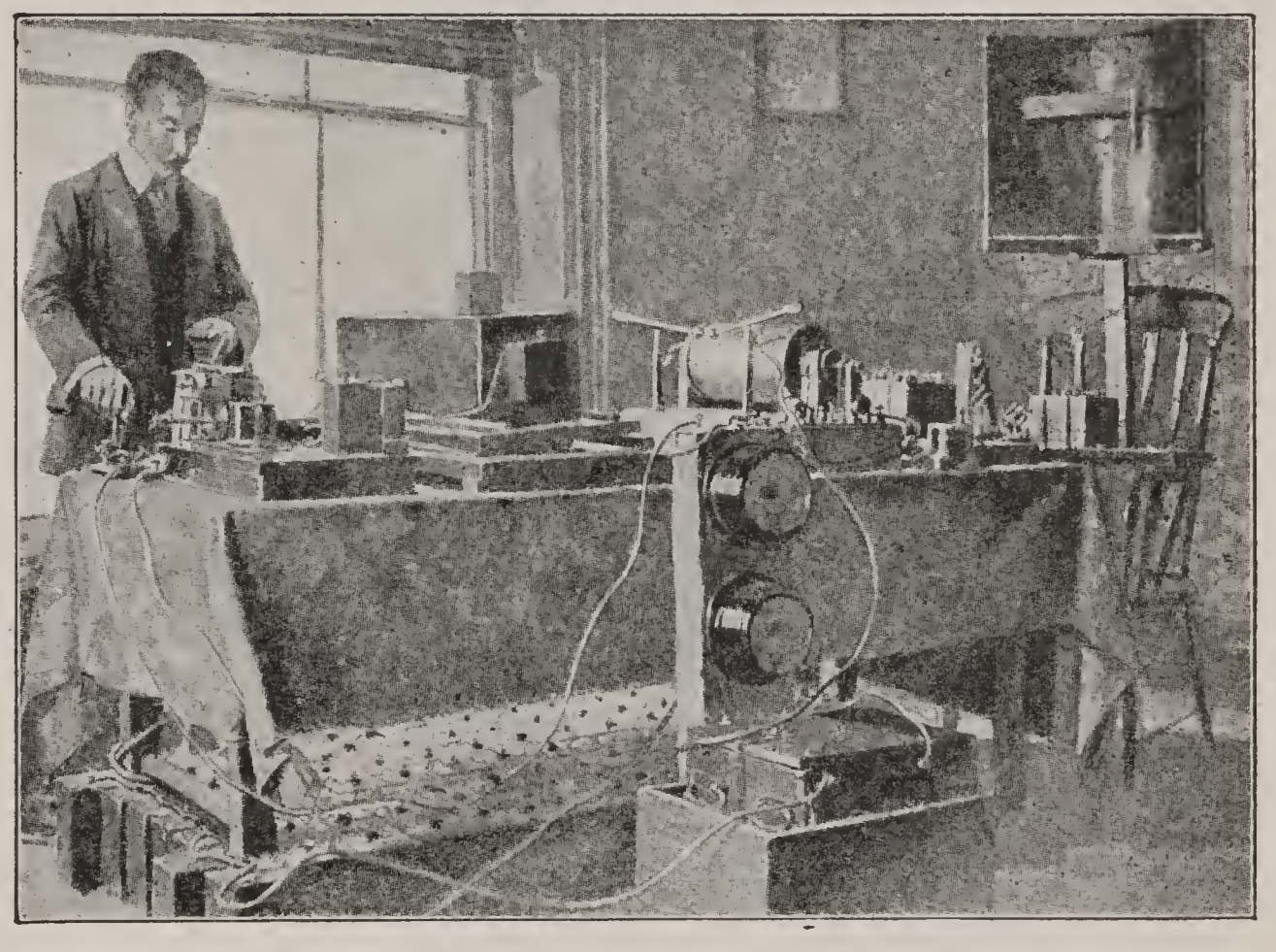
Discoverer and inventor of the Wireless Telegraph.

once set to work on improvements, and the following system has been the result:

Two tall poles are erected, one at the sending and one at the receiving station. From these poles are supported sprits, along each of which runs an ordinary copper wire extending vertically from the telegraph instruments into the air. The upper portion of the wire is bare, so that

the waves of energy may leap off into space as they are sent up the wire by the operation of the instrument below. This instrument is simply a large induction coil connected with a strong battery. To the coil are also attached two brass knobs (some distance apart), from the space between which, when the current is on, leaps a stream of sparks, the same as those produced in experiments with the X-ray. Now, when a message is being sent, the transmitting wire is charged with a current of electricity at high tension, which naturally rushes toward the earth. This discharge causes a rapid oscillation in the wire as long as the current continues. This oscillation must have an outlet, and, accordingly, leaves the wire for its journey across space. This agitation, when it reaches the receiving instrument, produces an opening and closing of the circuit accordingly as the waves are continuous or cut short. To use a simple example, let us suppose we have a string hanging loose from the ceiling. Now take a fan and wave the air. The result is the string is blown back. Make several motions with the fan at short intervals, and the string will respond to the air waves. This is similar to what occurs in Marconi's telegraphing process. He has a switch connected with the sending instrument, and as he opens or closes this a stream of electrical sparks follows. It may readily be seen, then, that as these sparks impart the waves to the transmitting wire, a short one would send a short wave across to the receiver, and a long stream would produce a long set of waves. That is just what happens.

When this much of the system was perfected, it was necessary to arrange some device whereby the gentle oscillations might be received and interpreted into messages. Here was a hard task, but it was successfully wrought out. In a metal box, that keeps out to a great extent the Hertzian waves, is a relay instrument, two devices called a "coherer" and a "tapper," and a Morse instrument for printing dots and dashes connected to a home battery. The



A WIRELESS TELEGRAPH STATION.

Showing operator in the act of sending a message. The large box on the table near the operator contains receiving instrument; the adjoining cylinder with the two rods ending in knobs is the sender; while in upper right-hand corner is the copper reflector used for directing the waves.

"Coherer"

is the principal and most delicate of all these instruments, and upon its actions depends the success of the sending opera-

tion. It consists of a tiny glass tube about as thick as that of a thermometer and two inches long. In either end is a small plug of silver, attached to the aërial wire on the pole outside and to a wire connected with the relay instrument. It must be understood that a wave so deli-



EXTERIOR VIEW OF A WIRELESS TELEGRAPH STATION.

From the sprit at the top of the mast is suspended the copper reflector which sends the Hertzian waves shooting across space. The wires attached to the mast are only for support in heavy winds.

cate in its impulse would not be able to operate a machine of itself; it is only strong enough to give the impulse that will complete the circuit of the home battery, and the latter then works the writing machine.

But how can this impulse be given in dots and dashes of the Morse telegraph code? Simply enough, when one knows how; and here came in Marconi's greatest discovery. He learned that nickel and silver were alternately good and bad conductors of the Hertzian waves: good when welded together by a continuous current, but bad when severed into particles by a blow from his little "tapper." Hence, he contrived an arrangement of very tiny particles of nickel and silver dust,—siftings through silk,—and placed them between the silver plugs of his "coherer." Now, when a wave impelled by a single spark from the transmitter is received by the vertical wire hanging in space from the pole of the receiving station, it comes down through the "coherer," and the tiny particles of nickel and silver cohere (hence the name), the current is imparted to the battery that sets the Morse instrument to printing a dot.

To explain more clearly just the uses of the "coherer" and the "tapper," we must remember that the power of the Hertzian wave is very slight; in fact, it could create no electrical disturbance were it not for its property of welding together the nickel and silver filings in the "coherer." What it can do, however, is to complete the circuit that will operate the relay instrument. Let us imagine the circuit of the relay is like an electric door-bell. Well, the coherer is in the place of the push-button. As long as the filings are separate there is no sound, for the circuit is not complete. But let a Hertzian wave strike the coherer and the filings are welded together, the circuit is completed and the relay instrument gives the sufficient electrical energy to operate the writing machine or ticker. But so long as the filings in the coherer are in cohesion the instrument will keep up one continuous buzz; hence no intelligible signals could be sent. Here is where Marconi made use of his.

Decoherer or "Tapper."

It is no more than a little hammer attached to an electro-magnet, which, when operated by electricity, will tap against the coherer the same as the tapper of an electric bell; and this blow decoheres the filings. Now, when the Hertzian wave reaches the receiving station it rushes down to the coherer, the filings are welded together, the circuit is completed, and the instrument ticks off its dot. At this instant the relay instrument has also sent a current to the electro-magnet of the tapper. The magnet draws back the little hammer and lets it strike the coherer, the filings are separated, and the station is ready to receive the next flash.

Each succession of waves produces the same effect, and the operation is repeated, the result being an intelligible series of dots and dashes which are readily translated into their proper meaning.

Messages by wireless telegraphy have already been sent with accuracy up to 110 miles, of which sixty were over water and the rest over land. Messages are not lost by the curvature of the earth, which is about 1,000 feet in eighty miles, and they work all right from a wire 130 feet high. Weather conditions cannot interfere, nor can the messages be stolen, for the reason that the transmitters and receivers must be in "tune,"—that is, they must work in harmony. This makes it almost impossible for the receiver to take a message not intended for him. The electric waves do not seem to be impeded by buildings or hills in the intervening space, for experiments have shown that messages sent to given destinations, between which and the sender were high hills, buildings, etc., have been accurately received. Whether the Hertzian waves go through or around the intercepting object has not yet been ascertained.

The Principal Cost

of installing a wireless telegraph plant is that of the poles, the receivers costing only about $60. The expense of maintaining the electrical current is nominal. Each station has both a sending and a receiving instrument, one being turned off when the other is in operation. Messages can now be sent at the rate of twenty-five words a minute, so it may readily be seen that when the system is still more perfect, it may threaten the established telegraph lines. Imagine another Eiffel tower on this side of the Atlantic, with sending and receiving stations here and at Paris. The expense of laying and operating the great submarine cables would be entirely done away with.

Already the system is in use on lightships, connecting them with the life-saving stations on shore, and many lives and much property have been saved by its use. What, then, if every ship or train had these instruments? Accidents might be avoided, news imparted without stopping, directions given for war vessels' manœuvres, and countless other similar uses. Marconi thinks some of the greatest improvements in this line are yet to come. He has already devised a sort of reflector that concentrates the waves and shoots them in one direction, like a search-light, so that they may be directed at will, and only to certain spots. He is also working upon an arrangement that will tell from what direction a message comes. He speaks of possibly arranging a set of senders and receivers and so manipulating them for subscribers that

The News of the Day

can be telegraphed all over the country, thus doing away with newspapers

Modern Wonders of the Electrical World.

RAPID TELEGRAPHY, PICTURES BY WIRE, STIMULATING THE GROWTH OF PLANTS BY ELECTRICITY, ETC.

The marvelous strides taken by American genius in the perfection of new devices and inventions which harness this weird fluid of the air and make it do service in the aid of man.

ASIDE from such marvelous discoveries as the wireless telegraph, the X-rays and the uses to which electricity has been put as a motive power, there are many minor experiments that are daily being made which are rapidly bringing this weird fluid nearer and nearer to our daily life, both for comfort and for money-making. A directory recently published gives the names of 25,464 firms carrying on electrical business throughout the world. The United States, as in most other things, is taking the lead in this important work. Daily we are shipping to Europe and the Orient motors and electrical storage outfits in great numbers.

While in many instances the American trolley system for street cars has proved dangerous, it is, nevertheless, being rapidly taken up in Europe. Electrical plows are being installed on the larger farms, and lighting by electricity is now almost universal. The success of using water power at Niagara and elsewhere for generating this force is remarkable, and the use of the tides about Manhattan Island, upon which New York City is situated, for this purpose has been advanced as tenable

Telegraphing 100,000 Words an Hour.

In telegraphing many improvements have been made, among others being one system whereby the wires are attached to a sort of electrical typewriter, which, upon being operated, sets in motion a similar machine at the other end. The benefit of this system is that the operator does not need to be acquainted with any particular method, any one who is able to spell being competent to work the machine. Another recent invention in this line is a method of perforating strips of paper with a machine similar to a typewriter, and then placing these strips into the sending device, which transmits the messages at the rate of 100,000 words an hour. This is a marvelous speed, and where the time is saved is that a number of men can be set to work at one time perforating the strips before using the wire for sending. The benefit to be derived from such a system is that there would be a great saving in laying additional lines, for once the strips are prepared the sending occupies the line but a few moments.

Picture Telegraphy.

Sending pictures by wire has at last come so near to perfection that it is being used to some extent in detective work. The method used is called telepantography. By it an engraving or artist's sketch may be sent over almost any distance by common telegraph communication. If a picture is to be transmitted it must first be treated to a process similar to that for a half-tone engraving. A

HISTORY OF THE WORLD

FROM THE

EARLIEST RECORDS TO THE PRESENT TIME.

ANCIENT HISTORY DOWN TO THE CHRISTIAN ERA.

B. C.

2324 Beginning of Chaldean astronomical observations sent by Callisthenes to Aristotle.

2229 Assyria founded by Ashur.

2200 The Hya dyanasty founded in China.

2188 Egypt settled by Misriam.

3100 Babylon founded by Nimrod.

2000 Cuneiform writing in use.

2000 Nineveh founded by Ninus.

1996 Birth of Abraham.

1921 Call of Abraham.

1896 Birth of Isaac.

1856 Kingdom of Argos founded.

1837 Birth of Jacob and Esau.

1729 Joseph sold by his Egypt.

1582 Beginning of the chronology of the Arundelian marble slabs which were brought to England in Anna Domini 1627.

1571 Birth of Moses.

1500 Sesostris, King of Egypt.

1491 Passover instituted. Departure of the Israelites from Egypt.

1450 Death of Moses and Aaron. Israelites enter Canaan.

1352 to 1193. Rule of the Judges in Israel.

1184 Trojan War.

1273 Rise of the Assyrian Empire.

B. C.

1136 Samson slays the Phillistines.

1120 Death of Samson.

1125 Samuel the Prophet.

1100 The Chow dynasty founded in China.

1095 Saul made King of Israel.

1075 Death of Samuel.

1056 Death of Saul and Jonathan.

1055 David, King of Israel.

1050 Codrus King of Athens.

1048 David takes Jerusalem.

1048 to 1006. Tyre flourishes under Hiram.

1042 The Ark removed to Jerusalem.

1023 The revolt of Absalom.

1015 Death of David. Accession of Solomon.

1012 Solomon's Temple begun.

1005 Completion and dedication of Solomon's Temple.

975 Rehoboam, King after Solomon:

971 Revolt of the Ten Tribes under Jeroboam.

971 Egyptians capture Jerusalem.

884 Lycurgus reforms Spartan Constitution.

878 Carthage founded by Dido.

776 The Olympiads. First authentic date in Greek History.

758 Syracuse founded.

753 Rome founded.

B. C.

747 Babylon independent under Nebonassar.

742-723 First Messinian War.

730 Shalmenezer subdued Phœnicia.

722 Samaria taken by Sargon, King of Assyria. End of the Kingdom of Israel. Judaa remains 130 years longer.

720 Sennacherib besieges Jerusalem—his army destroyed.

700 Numa Pompilius, King of Rome.

687 Second Messinian War.

624 Draco's Laws at Athens.

602 King Jehoiakim revolts from Babylon.

598 Capture of Jerusalem by Nebuchadnezzar.

594 Legislation of Solon at Athens.

588 Pythian games begin celebration every 5 years.

586 Jerusalem destroyed by Nebuchadnezzar. End of the Kingdom of Judah.

579 Nebuchadnezzar takes Tyre.

569 Same Monarch conquers Egypt.

559 Persian Empire founded by Cyrus.

554 Cyrus conquers Lydia and captures Croesus.

540-10 Era of Pythagoras.

539 Marseilles founded by the Phoenicians.

538 Cyrus captures Babylon.

B. C.

536 Cyrus releases Jews from captivity.

535 Temple at Jerusalem rebuilt.

529 Death of Cyrus. Cambyses succeeds him.

525 Conquest of Egypt by Cambyses.

521 Darius I, King of Persia.

518 Birth of Pindar.

515 2nd Temple dedicated.

510 Tarquins Expelled.

510 Rome and Athens become Republics.

508 First Treaty, Rome and Carthage.

507-06 Darius makes conquest of Thrace, Pæonia and Macedonia.

490 Coriolanus banished from Rome.

490 Battle of Marathon. (Victory gained by the Greeks over the Persians.)

480 Battle at the Pass of Thermopylæ. (Victory gained by the Greeks over the Persians.)

480 Battle of Salamis. (Victory gained by the Greeks over the Persians.)

479 Battle of Platæa. (Victory gained by the Greeks over the Persians.)

471 Banishment of Themistocles for ten years.

460 Ezra and Nehemiah rebuild Jerusalem.

458 Cincinnatus taken from the plough to be dictator.

B. C.

430 Thucydides born.

429–348 Plato lived and flourished.

429 Death of Pericles.

425 Athenians capture Pylos.

421 The peace of Nicias with Sparta.

415 The Athenian expedition against Syracuse.

405 Destruction of the Athenian fleet at Ægos Potamos.

404 Athens compelled to surrender to the Spartans.

400 Xenophon born.

399 Socrates dies by poison.

385–332 Demosthenes flourished.

387 Peace of Antalcidas (Corinthian War).

371 Battle of Leuctra.

362 Battle of Mantinea.

350 Destruction of Sidon.

342 War between the Romans and Latins.

338 Battle of Chæronea, liberty of Greece ended.

334 Battle of Granicus (Persians defeated).

332 Destruction of Tyre by Alexander.

331 Battles of Arbela and Gaugamela.

324 Diogenes flourished.

323 Alexander the Great dies.

322 Demosthenes commits suicide.

317 Syracuse besieged by the Carthaginians.

316 Antigonus is acknowledged regent of Alexander's empire.

314 Æschines flourished.

312 The Stoics flourished.

301 Battle of Ipsus. (Defeat of Antigonus.)

295 Samnites defeated by the Romans.

284 The translation of the Bible from Hebrew to Greek.

281 Pyrrhus wars with Rome.

280 Theocritus flourished.

B. C.

280 Euclid flourished.

275 Pyrrhus defeated by the Romans at Beneventum.

261 The Romans win their first naval battle at Mylæ.

260 The Epicureans flourish.

242 The Carthaginians defeated by the Romans.

222 The Cisalpine Gauls are defeated by the Romans.

217 Hannibal crosses the Apennines.

216 Defeats the Romans at Cannæ.

212 Archimedes flourished.

212 Syracuse destroyed.

211 The Capuans, deserted by Hannibal, surrender to Rome.

204 Scipio passes over into Africa.

202 Battle of Zama. Defeat of the Carthaginians.

197 Greece freed from Rome.

148 Macedonia made a Roman province.

146 Corinth destroyed.

135 The Maccabees are governors and high priests of Judea.

135 Numantia taken by Scipio.

113 The Romans defeated by the Teutones and Cimbri.

109 Metellus is sent into Africa against Jugurtha.

107 C. Marius chosen consul by the people.

102 The Teutones are defeated at Aquæ Sextiæ by Marius.

88 The Social War.

88 Sylla sent against Mithridates (first Mithridatic war).

87 Athens captured by Sylla.

86 Marius is chosen consul for the seventh time, but dies a few months after.

74–65 The second Mithridatic war.

B. C.

72 The revolt of the slaves.

66 Pompey subdues the Armenians and defeats Mithridates.

60 The Triumvirate formed (Pompey, Cæsar, Crassus).

58–50 Cæsar's wars in Gaul.

49, 48 The second civil war at Rome.

49 Cæsar advances upon Rome with his army.

48 Pompey defeated at Pharsalus: is assassinated in Egypt.

44 Cæsar assassinated.

43 Second Triumvirate formed. (Octavius, Anthony, Lepidus.)

42 The Republicans, under Brutus and Cassius, defeated at Philippi.

31 Victory of Octavius at Actium.

30 Egypt a province of Rome.

B. C. 30 } Augustus, Em-
A. D 14 } peror.

4 Birth of Jesus.

9 Romans under Varus defeated by Germans.

14 Tiberius Emperor of Rome.

29 Crucifixion of Jesus.

40 Disciples of Jesus first called Christians.

43 Romans under Claudius invade Britain.

64 First Persecution of Christians at Rome.

70 Titus destroys Jerusalem.

78 Agricola Commands in Britain.

95 Second Persecution. (Rome and Syria.)

103 Trajan subdues the Dacians.

110 Third Persecution (Bithynia).

118 Fourth Persecution (Asia Minor).

125 The Jewish nation, as a state, at an end.

137 Jerusalem restored under the name Ælia Cepitolina.

A. D.

167 Fifth Persecution (Smyrna)—Martyrdom of Polycarp.

177 Sixth Persecution (Lyons).

193 Septimius Severus, Emperor of Rome.

202 Seventh Persecution (Egypt).

211 Death of Severus at York.

236 Eighth Persecution (Asia Minor).

250 Ninth Persecution (Rome and Provinces.

258 Tenth Persecution (Rome and Africa).

261 Capture of Antioch by Sapor.

273 Defeat of Zenobia and capture of Palmyra by Aurelian.

286 Division of the Empire between Diocletian and Maximian.

288–300 Britain independent under Carausius and Allectus.

303 Eleventh Persecution, beginning at Nicomedia.

306 Accession of Constantine.

308 Six Emperors at once.

324 Constantine sole ruler.

325 First General Council held at Nicæa.

330 Dedication of Constantinople.

364 Division of the Empire under Valens and Valentinian.

376 Goths allowed to settle in Thrace.

381 Second General Council held at Constantinople.

394 Paganism abolished by law.

395 Arcadius rules the East; Honorius the West.

410 Rome sacked by Alaric.

410 Romans leave Britain.

418 Pharamond, King of the Franks.

431 Third General Council at Ephesus.

439 Vandals take Carthage.

A. D.

449 Angles, Saxons, and Jutes invade Britain.

451 Fourth General Council at Chalcedon.

451 Battle of Chalons between Romans and Goths under Aetius and Theodoric, and Huns under Attila.

455 Rome sacked by the Vandals.

476 Fall of the Western Empire, 507 years after battle of Actium and 1229 from the building of Rome.

486 Clovis King of the Franks conquers the country between the Seine and Loire Rivers. Won battle of Soissons.

488 The Ostrogoths seize Italy.

500 Mohammed flourished.

510 Paris the capital of Clovis.

515 Supposed reign of Arthur in Britain.

527 Justinian begins to reign.

533 Victories of Belisarius in Africa.

536–39 Victories of Balisarius in Italy.

550 Foundation of Poland by Lech.

551 Silk manufacture first known in Europe.

553 Ostrogothic kingdom in Italy ends.

568 Lombards conquer Italy.

571 Birth of Mohammed.

596 Mission of Augustine to Britain.

622 The Hegira.

632 Death of Mohammed.

637 Jerusalem taken by Omar.

640 Alexandria captured by the Mohammedans under Amru.

668–75 Saracens foiled at Constantinople.

680 Sixth General Council at Constantinople.

711 Invasion of Spain by the Saracens.

716–18 Second fruitless siege of Constantinople.

A. D.

732 Defeat of Saracens by C. Martel in the great battle of Tours.

750 The Abbasides get the caliphate.

752 Tepin le Bref made King of France.

771 Charlemagne sole ruler of the Franks.

778 Battle of Roncevalles.

786 Haroun al Raschid caliph.

787 Seventh General Council (at Nice).

787 First landing of Danes in England.

788 Irene, empress of the East.

800 Charlemagne crowned at Rome.

814 Charlemagne's death.

827 Egbert sole ruler of England.

841 Battle of Fontenaille.

843 Treaty of Verdun.

862 Ruric founds the Russian Empire.

871 Alfred the Great King of England.

875 Harold Fairhair founded Kingdom of Norway.

901 Alfred's death.

911 Rollo the Norseman obtains Neustria.

911 Conrad I., Emperor of Germany.

936 Otho the Great, Emperor of Germany.

940 Emir al Omra first appointed.

962 Otho crowned Emperor of the West.

969–75 John Zimisces, Emperor of the East.

973 Otho's death.

987 Capetian dynasty begins in France (Hugh Capet King).

1017 Canute the Dane on the English Throne.

1040 Normans conquer South Italy.

1041 Edward the Confessor restores the Saxon line in England.

1055 Bagdad taken by the Turks.

1061 The Guelph and Ghibelline Feud begins.

A. D.

1065 Jerusalem taken by the Turks.

1066 The Norman conquest of England.

1081 Battle of Durazzo.

1081 Gregory deposed.

1096 The First Crusade.

1099 Jerusalem taken by Crusaders.

1102 Guiscard of Normandy, King of Naples.

1118 Knights Templars instituted.

1137 Justinian's Pandects discovered at Amalfi.

1147 The Second Crusade.

1152 Frederick Barbarossa, Emperor of Germany.

1154 Accession of Plantagenets in England.

1170 Thomas à Becker died.

1172 Invasion of Ireland under Henry II. of England.

1176 Germans under Frederick defeated at Legnano.

1187 Jerusalem taken by Saladin.

1189 The Third Crusade.

1189 Richard (the Lionhearted) King of England.

1195 The Fourth Crusade.

1198 The Fifth Crusade.

1203 Conquest of Constantinople by the Crusaders.

1208 War against Albigenses in Languedoc.

1212 The Boy Crusade.

1215 Magna Charta signed by John of England.

1227 The Sixth Crusade.

1227 Zenghis Khan overruns the Saracen empire.

1233 Inquisition formally established by Gregory IX.

1237 Russia made tributary to the Moguls.

1248 The Seventh Crusade.

1258 End of the Abbaside Caliphs.

1261 The Greeks retake Constantinople.

A. D.

1270 The Eighth Crusade —death of St. Louis.

1270 Egypt falls into the hands of Mamelukes.

1273 Rudolph of Hapsburg elected Emperor of Germany.

1281 Conquest of Prussia by the Teutonic Order.

1282 Conquest of Wales by Edward I. of England.

1291 Acre taken by the Turks—end of the Crusades.

1302 Battle of Courtrai.

1305 Seat of the Popedom removed to Avignon.

1307 The Swiss Revolution begins.

1314 Battle of Bannockburn.

1315 Battle of Morgarten.

1346 Battle of Cressy.

1347 Rienzi tribune of Rome.

1452 Unien of the eight Swiss Cantons.

1356 Charles IV. of Germany institutes the Golden Bull—the fundamental law of the Empire.

1360 Calais and the S. W. of France ceded to England.

1361–89 Ottomans under Murad I. conquer Asia Minor and pass into Europe.

1364 Final embodiment of the Hanseatic League by Act signed at Cologne.

1377 Return of the Popes to Rome.

1386 Battle of Sempach.

1392 The Cape of Good Hope discovered by the Portuguese.

1397 The Treaty of Calmar, uniting Denmark, Sweden and Norway under Margaret.

1398 Tamerlane takes Delhi.

1399 Henry IV. (Lancaster) King of England.

1402 Tamerlane defeats the Turks at Angora.

1415 Battle of Agincourt.

1414 John Huss burned.

A. D.

1416 Jerome of Prague burned.

1428 Cosmo de Medici flourished (Florence).

1428 Joan of Arc victorious at Orleans.

1431 Her death.

1444 Gutteuburg prints at Strasburg.

1445 Accession of Constantine Palæologus, last of the Byzantine Emperors.

1453 Constantinople taken by the Turks.

1455 Wars of the Roses begin in England.

1473 Copernicus flourished.

1474 Michel Angelo flourished.

1478 Lorenzo the Magnificent rules Florence.

1479 Union of Castile and Aragon under Ferdinand and Isabella.

1483 Raphael flourished.

1485 Battle of Bosworth.

1491 Fall of Granada.

1492 Columbus discovers America.

1494 Invasion of Italy by Charles VIII. of France.

1497 Cape of Good Hope doubled by Vasco di Gama.

1497 Cabot explores coast of North America.

1498 Savonarola burned at Florence.

1499 Switzerland independent.

1504 Battle of Cerizoles—the French lose Naples.

1503 League of Cambray against Venice.

1513 Battle of Flodden.

1515 Francis I. becomes King of France.

1516 Charles I. becomes King of Spain.

1517 Luther publishes his ninety-five Theses.

1519 Charles I. of Spain becomes Emperor Charles V.

1519 The Disputation at Leipsic.

1520 Luther burns the Papal Bull.

A. D.

1521 Cortez takes Mexico.

1525 Battle of Pavia.

1527 The sack of Rome by Bourbon Troops.

1529 The Reformers first called Protestants at Spires.

1530 The League of Smalcald.

1533 Pizarro conquers Peru.

1535 The Order of Jesuits founded by Loyola.

1545 The Council of Trent begins to sit.

1549 Charles V. grants the Interim.

1552 The Treaty of Passau.

1556 The abdication of Charles V.

1558 Elizabeth becomes Queen of England.

1558 The Inquisition established in France.

1562 Battle of Dreux.

1570 The Peace of St. Germain en Laye.

1571 Battle of Lepanto—Turks defeated by Don John of Austria.

1572 The Massacre of St. Bartholomew.

1574 Siege of Leyden.

1579 The Union of Utrecht.

1587 Mary Queen of Scots beheaded.

1588 Defeat of the Spanish Armada.

1589 Henry IV. (first royal Bourbon) becomes King of France.

1590 Battle of Ivry.

1598 The Edict of Nantes.

1598 Peace of Vervins.

1603 Union of the English and Scottish Crowns.

1610 Assassination of Henry IV.

1618 Opening of the Thirty Years' War.

1620 Defeat of the Elector Frederick at Prague.

1624 Richelieu gains a seat in the Council.

1628 The Siege of Rochelle.

1629 Peace of Lubeck.

A. D.

1630 Gustavus Adolphus lands in Pomerania.

1630 Sack of Magdeburg.

1631 Battle of Leipsic.

1632 Battle of Lutzen—Death of Gustavus Adolphus.

1648 The great Peace of Munster or Westphalia.

1649 Charles I. of England beheaded.

1653 Cromwell, Protector of England.

1660 The restoration of the Stuarts in England.

1668 Peace of Aix-la-Chapelle.

1674 Battle of Seneffe.

1678 Treaty of Nineguen.

1679 Habeas Corpus Act passed in England.

1683 John Sebieski of Poland defeats the Turks at Vienna.

1685 The Edict of Nantes revoked by Louis XIV.

1686 The League of Augsburg.

1688 The second English Revolution.

1689 Peter the Great, sole ruler of Russia.

1690 Battle of the Boyne.

1692 Battle of La Hague.

1697 Treaty of Ryswick.

1697 Charles XII. becomes King of Sweden.

1699 Settlement of Louisiana.

1700 Battle of Narva.

1701 The Grand Alliance.

1702 French fleet destroyed at Vigo.

1704 Battle of Blenheim.

1706 Battle of Ramillies.

1709 Union of England and Scotland.

1708 Battle of Oudenarde.

1709 Battle of Pultowa.

1709 Battle of Malplaquet.

1713 Treaty of Utrecht.

1714 The Guelphs ascend the English throne.

1715 Death of Louis XIV. of France.

A. D.

1718 Charles XII. of Sweden killed at Frederickshall.

1725 Death of Peter the Great.

1740 Frederic the Great becomes King of Prussia.

1742 Treaty of Breslau.

1743 Battle of Dettingen.

1745 Battle of Fontenoy.

1745 Peace of Dresden.

1748 Second Peace of Aix-la-Chapelle.

1755 Braddock's defeat.

1755 Earthquake in Lisbon.

1755 Acadian exile.

1756 The Seven Years' War begins.

1757 Battles of Rossbach and Leuthen.

1757 Fort William Henry captured by Montcalm.

1758 Battle of Zorndorff.

1759 Battle of Minden.

1759 Schiller flourished.

1759 Battle of Quebec and death of Wolfe.

1762 Catherine the Great flourished in Russia.

1763 Close of the Seven Years' War—Peace of Paris.

1763 Canada becomes British territory.

1764 Pontiac's War.

1765 Stamp Act passed.

1766 Stamp Act repealed.

1768 War begins between Russia and Turkey.

1769 Birth of Napoleon Bonaparte.

1770 Boston Massacre.

1771 Gustavus III. flourished.

1772 First partition of Poland.

1773 Tea destroyed in Boston.

1774 Accession of Louis XVI. of France.

1774 Boston harbor closed by the British.

1775 Beginning of American war of the Revolution.

A. D.

1775 Battle of Bunker Hill.

1776 Declaration of Independence.

1776 Battles of Long Island and Trenton.

1777 Battles Bennington, Brandywine and Germantown.

1778 French American alliance formed

1778 Battle of Monmouth.

1779 Spain forms alliance with America.

1780 Battles of Charleston and Camden, Americans defeated.

1782 Surrender of Cornwallis, end of Revolutionary War.

1783 Independence of America, conceded by England.

1786 Shay's rebellion in Massachusetts.

1786 Frederick the Great died.

1787 The Assembly of the French Notables.

1788 Gustavus III. wages war with Russia.

1789 Meeting of the States-Generals.

1789 Opening of the first French Revolution.

1789 Constitution of the U. S. goes into effect.

1789 George Washington, President.

1789 Storming of the Bastille.

1790 Netherlands declare their Independence.

1791 Death of Mirabeau.

1791 French Legislative Assembly begins to sit.

1791 Canada is given a Constitution.

1792 Attack on the Tuileries.

1792 Battle of Jemappes.

1792 The National Convention begins to sit.

1793 Louis XVI. of France guillotined.

1793 The Reign of Terror.

1793 Cotton gin invented.

1793 Poland partitioned between Russia and Prussia.

1794 Execution of Robespierre.

A. D.

1794 Toronto made Capital of Upper Canada.

1795 The Directory established.

1795 Bonaparte scatters the National Guard.

1796 His splendid campaign in Italy.

1796 Battles of Lodi, Arcola, Rivoli and La Favorita.

1797 Treaty of Campo Formio.

1797 John Adams, President, U. S.

1797 Peace of Tolentino.

1798 The Battle of the Pyramids.

1799 Directory overturned—Bonaparte First Consul.

1799 French victory at Aboukir.

1800 Passage of the Alps.

1800 Bonaparte defeats Austrians at Marengo and Hohenlinden.

1801 Thomas Jefferson, President, U. S.

1801 Union of Great Britain and Ireland.

1801 Treaty of Luneville.

1802 Treaty of Amiens.

1802 Napoleon made First Consul for life.

1803 Renewal of war between England and France.

1803 Louisiana purchase.

1803 Swiss Cantons made independent.

1803 War with Tripoli.

1803 Slavery abolished in Canada.

1804 Napoleon I. elected Emperor of the French.

1805 Battles of Trafalgar and Austerlitz. Death of Nelson.

1805 Treaty of Pressburg.

1806 Battle of Jena. Death of Pitt.

1807 Battles of Eylau, Friedland and Copenhagen.

1807 Lisbon court flees to Brazil.

1807 Fulton's first Steamboat plies the Hudson.

A. D.

1808 Opening of the Peninsular War. Joseph Bonaparte named King of Spain.

1809 Battle of Wagram.

1809 Treaty of Schonbrunn.

1809 Napoleon divorces Josephine.

1809 Napoleon, being excommunicated, imprisons the Pope.

1809 Wellington defeats French at Talavera.

1809 James Madison, President, U. S.

1810 Napoleon marries Maria Louisa of Austria.

1811 Birth of Napoleon's Son "King of Rome."

1811 Battle of Tippecanoe.

1812 Terrible Russian Campaign.

1812 War between America and England.

1813 Battles of Lake Erie and the Thames.

1813 Battles of Lutzen, Bautzen, Vittoria and Leipsic.

1814 The allies enter Paris.

1814 Napoleon banished to Elba.

1814 Battle of Lundy's Lane.

1814 Burning of Washington by the British.

1815 Return of Napoleon from Elba and Battle of Waterloo, Wellington victorious and Napoleon banished to St. Helena.

1815 Second Peace of Paris.

1815 Formation of Holy Alliance.

1815 Battle of New Orleans, Jackson's victory.

1817 James Monroe, President, U. S.

1820 Revolution in Spain.

1821 Rising of Ypsilanti in Moldavia.

1821 The Missouri Compromise.

1821 Death of Napoleon.

1821 Greek War for Independence.

A. D.

1822 Brazil severed from Portugal.

1824 Welland canal.

1824 Accession of Charles X. of France.

1824 Death of Lord Byron.

1825 John Quincy Adams, President, U. S.

1825 Agitation in Canada over Alien Bill.

1825 First steamer crossed the Atlantic.

1826 Missolonghi taken.

1827 Battle of Navarino.

1829 Andrew Jackson, President, U. S.

1829 Agitation for responsible government in Upper Canada.

1829 Friction matches first used.

1830 Lord Aylmer, Governor of Lower Canada.

1830 Algiers taken by the French.

1830 Second French Revolution.

1830 Revolution in Brussels.

1831 Battle of Ostrolenka.

1831 Belgium separated from Holland.

1831 Surrender of Warsaw and Prague.

1832 Otho elected King of Greece.

1832 Imperial duties surrendered to Canadian Assembly.

1832 South Carolina Nullification Act.

1835 Slave Emancipation bill passed by England.

1835 First electric telegraph.

1837 Canadian Insurrection.

1837 Victoria, Queen of Great Britain.

1837 Martin Van Buren, President of U. S.

1839 Union of Upper and Lower Canada.—Lord Sydenham, Governor.

1839 The Carlist leader, Maroto, lays down his arms.

A. D.

1840 Responsible government established in Canada.

1840 Frederick William IV., King of Prussia.

1840 Queen Victoria marries Albert of Saxe-Coburg.

1841 W. H. Harrison, President, U. S.—died same year.

1842 Corn Laws relaxed.

1842 Treaty settling North Eastern boundary of the U. S.

1844 Canadian government removed to Montreal.

1845 Annexation of Texas,

1845 Great fire at Quebec.

1845 Jas. K. Polk, President of U. S.

1846 Anesthetics first used.

1846 War between United States and Mexico.

1846 Taylor defeats Mexicans at Palo Alto, Resaca de la Palma and Montery.

1846 Northwestern boundary of U. S. settled by treaty.

1846 Doniphan defeats Mexicans at El Paso.

1847 Battles of Buena Vista, Sacramento, Vera Cruz, Cerro Gordo, Cherubusco, Molino-del-Rey, Chepultepec and the City of Mexico—all won by the Americans.

1848 Peace with Mexico.

1848 Francis Joseph, Emperor of Austria.

1848 Gold found in California.

1849 Hungary declared independent of Austria.

1849 The French enter Rome.

1851 World's Fair in London.

1852 Napoleon III. declared Emperor.

1852 Canadian government removed to Quebec.

1853 Franklin Pierce.

1853 Santa Ana, Dictator of Mexico.

A. D.

1854 Crimean War begun.—Battles of Alma, Balaklava, Inkerman and seige of Sebastopol.

1855 Sir Edmund W. Head, Governor of Canada.

1855 Alexander II., Czar.

1856 British War with China and Persia.

1856 Treaty of Paris.

1857 Great Commercial crisis.

1857 Indian Mutiny.

1857 James Buchanan, President, U. S.

1858 Jewish disabilities removed in Great Britain.

1858 First Atlantic cable.

1858 Livingstone's Zambezi expedition in Africa.

1859 War between France and Austria—Battles of Magenta and Solferino.

1859 Spanish War with Morocco.

1859 War between Austria and Italy.

1859 Charles XV. rules in Sweden and Norway.

1859 John Brown's insurrection.

1860 South Carolina secedes.

1860 Garibaldi invades Naples.

1861 Lord Monck Governor of Canada.

1861 Abraham Lincoln, President of U. S.

1861 Southern States secede.—Beginning of Civil War in America.—Battles of Bull Run and Wilson's Creek.

1861 William I. King of Prussia.

1861 Victor Emmanuel, King of Italy.

1861 Polish Insurrection.

1862 Battles of Antietam, Fort Donaldson, Pea Ridge, Shiloh, and the second of Bull Run in the Civil War.

1862 France makes War on Mexico.

1862 Bismark made Premier in Germany.

1863 Russia frees the Serfs.

A. D.

1863 Emancipation Proclamation.

1863 Battles of Chancellorsville and seige of Vicksburg and battle of Gettysburg.

1863 French enter City of Mexico.

1864 Battle of the Wilderness, siege of Petersburg and Sherman's march to the sea.

1864 Maximillian made Emperor of Mexico.

1864 Ionian Isles annexed to Greece.

1864 Prussia and Austria at war with Denmark.

1865 Battles of Five Forks, Petersburg, Richmond.—Surrender of the Confederates.—End of the Civil War.

1865 Lincoln assassinated.

1865 Great fire at Quebec.

1866 War between Germany and Austria.

1866 Battle of Sadowa.

1866 Austria withdraws from German confederation.

1867 English War with Abyssina.

1867 Dominion of Canada formed.

1867 Alaska purchased by the United States.

1867 Maximilian excuted.

1869 Disestablishment of the Irish Church.

1869 Cuban revolt.

1869 U.S.Grant, President.

1870 War between France and Germany.

1870 Battle of Sedan.

1870 Surrender of Napoleon III.

1870 German Empire formed.

1871 William of Prussia, Emperor.

1871 Commune and Republic in France.

1871 Great Fire in Chicago.

1872 Geneva award on the Alabama claims.

1873 Death of Napoleon III. in England.

A. D.

1875 Alfonso, Prince of the Asturias, King of Spain.

1876 Centennial celebration in Philadelphia.

1876 Queen Victoria, Empress of India.

1877 R. B. Hayes, President of the U. S.

1877 War between Russia and Turkey.

1877 Great Fire at St. John, New Brunswick.

1878 War in Afghanistan.

1878 Death of Victor Emmanuel, and Humbert made King.

1878 Pius IX. dies, and Leo XIII. made Pope.

1878 Treaty of Berlin.

1878 Montenegro Independent.

1878 Roumania Independent.

1878 Servia a Free State.

1878 Yellow Fever Epidemic in U. S.

1878 Marquis of Lorne Viceroy in Canada.

1879 Zulu War.

1879 Jules Grevy, President of France.

1879 Queen Mercedes of Spain dies.

1879 War between Chili and Peru.

1880 Famine in Ireland.

1880 Slavery abolished in Cuba.

1881 James A. Garfield, President, U. S., killed, succeeded by Chester A. Arthur.

1881 Alexander II. of Russia assassinated.

1881 Greely North Pole Expedition.

1882 War in Egypt by England.

1883 Brooklyn Bridge opened.

1883 Indian War.

1884 Dynamite Explosion at Quebec.

1885 Grover Cleveland, President U. S.

1885 Rebellion of Louis Riel, in Canada.

1886 Anarchist Riot in Chicago.

A. D

1887 Sadi Carnot, President of France.

1887 Stanley penetrates the heart of Africa, gone two years.

1888 William I. of Germany dies, Son, Frederick III. succeeds. Dies soon after and his Son William II. made Emperor of Germany.

1888 Lord Sackville West, British Minister, dismissed from Washington.

1888 Lord Stanley Gov. General of Canada.

1889 Dom Pedro, Emperor of Brazil, deposed.

1889 Benjamin Harrison, President U. S.

1889 Great Fire in Quebec.

1889 Boulanger excitement in France.

1890 Duke of Orleans banished from Paris.

1890 Death of Sitting Bull. End of Indian Outbreak.

1890 11th Census of the United States.

1890 McKinley Tariff goes into effect.

1892 Birth of Peoples Party at Omaha.

1893 Cleveland President, 2nd term.

1893 World's Fair at Chicago.

1893 Financial depression in U S.

1893 Congress of Religions Chicago.

A. D.

1893 Revolutions in Brazil and Argentine Republic.

1893 Sherman Bill repealed.

1894 President Carnot of France assassinated.

1894 Nicholas II. Czar of Russia.

1894 War between China and Japan.

1894 Great Coal and Rail Road Strikes in United States.

1895 Armenians Massacred by the Turks.

1895 Venezuelan Boundary Dispute.

1895 Free Silver Movement in United States.

1895 Felix Faure, President of France.

1895 Cuban Revolt against Spain, War of Independence.

1896 Italians defeated in Abyssinia.

1896 Nicholas II. of Russia, Crowned.

1896 X-Ray discovered.

1896 Maceo the Cuban General killed.

1897 Wm. McKinley, President, U. S.

1897 War between Greece and Turkey. Greece defeated.

1897 Gold discovered in Klondike.

1897 Dingley Tariff Law enacted.

A. D.

1898 Destruction of U. S. Battleship Maine in harbor of Havana.

1898 Spanish-American War. Battles of Manila and Santiago. Spain defeated and loses Cuba, Porto Rico, and the Phillippines.

1898 Empress Elizabeth of Austria, assassinated.

1898 Dreyfus case in France.

1898 Universal Peace Conference held.

1898 Gold discovered at Cape Nome, Alaska.

1898 Death of the celebrated German statesman Bismarck.

1898 Venezuelan Boundary Dispute settled.

1898 Peace treaty signed by the Governments of the United States and Spain.

1898 Filipino War begins.

1899 South African War begins.

1899 President called for ten regiments to quell Filipino Insurrection.

1899 Vice-President Hobart died.

1900 World's Fair at Paris.

1900 Legations in Pekin attacked by Chinese.

1900 Gold Standard Currency Bill signed by President McKinley.

1900 King Humbert of Italy assassinated. His Son, Victor Emmanuel III. succeeds to throne.

A. D.

1900 Twelfth census of the United States.

1900 War of the Nations against China.

1900 McKinley re-elected President, U. S.

1900 Election in Canada retained Liberals in Power.

1900 Cuban Constitutional Convention called.

1900 Great Galveston Flood, causing the loss of nearly 5000 lives.

1901 Death of Queen Victoria and accession of King Edward VII.

1901 Death of Empress Frederick III of Germany.

1901 Second Inauguration of President McKinley.

1901 Capture of Aguinaldo, leader of the Filipino Insurgents.

1901 Danish West Indies purchased by United States.

1901 Great Strike of the Amalgamated Association of Labor against the United States Steel Corporation.

1901 Pan American Exposition at Buffalo.

1901 Assassination of President McKinley at the Pan-American Exposition.

1901 Vice-President Roosevelt sworn into office as President.

metal plate is made, very thin so that it may be bent round like the cylinder of a phonograph. The plate is slipped on the transmitting machine, and a tiny needle on this device traces over all the lines in the metal plate, in this way sending impressions to a cylinder at the other end of the line, about which is wrapped a coil of paper. An inked needle at the receiving end traces the lines as they are telegraphed, and a complete reproduction of the original picture is the result. The device is yet rather crude, but practical results have been obtained.

Electrical Plant Growth.

The qualities of electricity, though when in the form of lightning and strong direct currents readily take life, are such that in other forms as readily give life. Recently experiments have been made on seeds, and in one-half the time it takes Nature to turn out her work by ordinary processes, the application of electricity has brought out mature plants.

The first experiment was made on an egg that was being hatched. An electric current strong enough to kill a fowl did not destroy the germ of vitality, but the chicken when hatched was of most abnormal size and monstrous in shape. This proved, however, what might be done with this marvelous agent.

In plant stimulation the apparatus consists of two glass cylinders, a larger one about two inches in diameter for the larger seeds, and one about three-fourths of an inch for those of less size. Within these receptacles the seeds are placed, thoroughly moistened, and the openings closed with copper disks having wires attached. By these wires the disks are connected with the poles of an induction coil, and then the current is passed through the moist seeds, which are good conductors. After this treatment the seeds are placed in germinating pans. These consist of two plates one within the other, the inner being of porous clay. The seeds are sown between two sheets of filter paper, and water passing through the porous plate is absorbed by the paper, thus keeping the seeds moist at all times. The temperature is kept at about 48 degrees all the time by aid of electrical devices, and the growth of the plants is 30 per cent quicker by this method than otherwise, while, at the same time, many seeds not perfect enough to grow under ordinary climatic conditions are saved by this electrical treatment.

Wireless Light.

Nikola Tesla, one of the greatest of electrical wizards, has been at work some time perfecting several devices by means of which he can send wave impulses at great distances through the ether, but in different manner from the Marconi system. He has made the assertion that if Mars is inhabited he can create a great enough current to be felt there. He is also at work on wireless light. But both these inventions are as yet void of commercial value. Some time ago, at an exhibition in Chicago, he conducted a series of experiments in throwing his waves across space and directing miniature war vessels in a tank of water without the aid of connecting wires. Waves were sent across to a receiver, which opened currents that turned switches and set in motion the machinery. It is claimed for these inventions that, when perfected, torpedo boats can be more effectually directed toward the enemy's vessels.

New Studies of the Starry Skies.

ASTRONOMICAL PROBLEMS AND RECENT DISCOVERIES.

THE WORLD'S GREATEST TELESCOPE.

Achievements of the world's greatest star-gazers, and the latest and most delicate devices used by them, giving to the student new facts concerning orbits, seasons, atmospheres, and climatic and general conditions existing on the planets, moons and suns.

PROF. SIMON NEWCOMB, the well-known astronomer, uses a very startling method of comparing the size of the universe, so that we may judge its size by things earthy. Imagine the United States as the extent of the whole known creation, and compare to it a lady's finger-ring as the earth's orbit around the sun. The nearest fixed star would then be about a mile and a half away from the ring, and all the space from the Atlantic to the Mississippi would be studded with other stars, planets and constellations. It has recently been learned that the whole solar system, with the sun, earth and all the other planets, is traveling toward the constellation Lyra at the rate of three hundred millions of miles a year. When we think of this constellation as being about ten miles away from the finger-ring spoken of, we can readily see what enormous distances we are traveling, and little wonder is it that great minds are trying to solve the problem of where and when this vast and furious race began, and where it will end. An astronomer who might watch the heavens for ten thousand years might gain some faint suggestion of the answer to the riddle. But our sun and its system are not the only moving bodies in the universe.

Thousands Upon Millions

of other stars like our sun are traveling in some direction, and with greater or less force. A greater question, then, is what means the motion of all these other bodies, and where will they end? Some astronomers suggest that each system is shooting off on a curve that thousands of centuries will complete into orbits. Others say that if the laws of motion be true for all space and all time, it may be that each moving star will go on in an unbending career forever, unless attracted aside by others. In that case, after absorbing many smaller stars, a few of the larger bodies would gradually drift apart and the inhabitants of each would then behold only black and starless skies. All this is amazing in its proportions and grandeur, but as yet theories only exist, for with millions of bodies flying in different directions and at such frightful speed as 200 miles a second, calculations are at best but weak.

Another problem that presents itself to star-gazers is that of the

Size of the Whole Universe.

With the latest improved telescopes we are able to see only what is considered a very small portion of the vast extent of star-filled space. We are able at present to count, by means of photographic telescopes, some hundred millions of these bodies, but it is not supposed that we have reached anywhere near the edge of the limits of their confines. In fact, astronomers hardly think they will be able ever to know when they have found a limit, for even then there might be a great intervening empty space, but farther on possibly another vast field full of these sparkling lights. It is said that it is not probable that these stellar systems go on infinitely, for mathematicians have figured out that if such were the case, the light thrown off from such a number of luminous bodies would light up the whole heavens as brightly as at noonday. What the solution of this question is must remain in doubt, it seems, forever.



A PHOTOGRAPH OF THE MILKY WAY.

Showing a portion of the myriads of nebulous bodies that make up that great path through the heavens.

Following close upon this comes the thought,

Whence Comes the Heat

from the sun and other stars? and where does it go? We have decided quite accurately that meteors and other falling stars do not start out on their voyage through space on fire, but rather are solid bodies which, when they pass so rapidly through the air, are burned up by the heat of friction. Similarly it is thought that the contraction of the bodies of these stars through the gravitation of their parts

creates heat so great that combustion is the result, and when the bodies finally become dense as the earth they grow cold. This theory is pretty well founded upon observations of the sun, and while the conclusion is that this is the proper solution of the problem, yet the process is very slow,—so slow that it would have to go on for thousands of years before astronomers could find by comparing sizes that it had grown any smaller



AN ECLIPSE OF THE SUN.

Caused by the passage of the moon between the sun and the earth.

Though this problem is solved to an extent, where does the heat vanish? is altogether a harder question. What becomes of the flood of heat and light that has gone on at the rate of 180,000 miles a second since the dawn of creation? Science of to-day might say that it continues through space forever. But at such a marvelous velocity it seems that in a few thousand years it should have reached the confines of space, if there be any, and there is no reason why it should stop there. There is a law of conservation of energy that maintains that nothing is lost here on earth: no gas that escapes but that it returns to nature in some form. May it not be true that the heat so long thrown off from our burning worlds may return? We cannot say; it remains a problem unanswered.

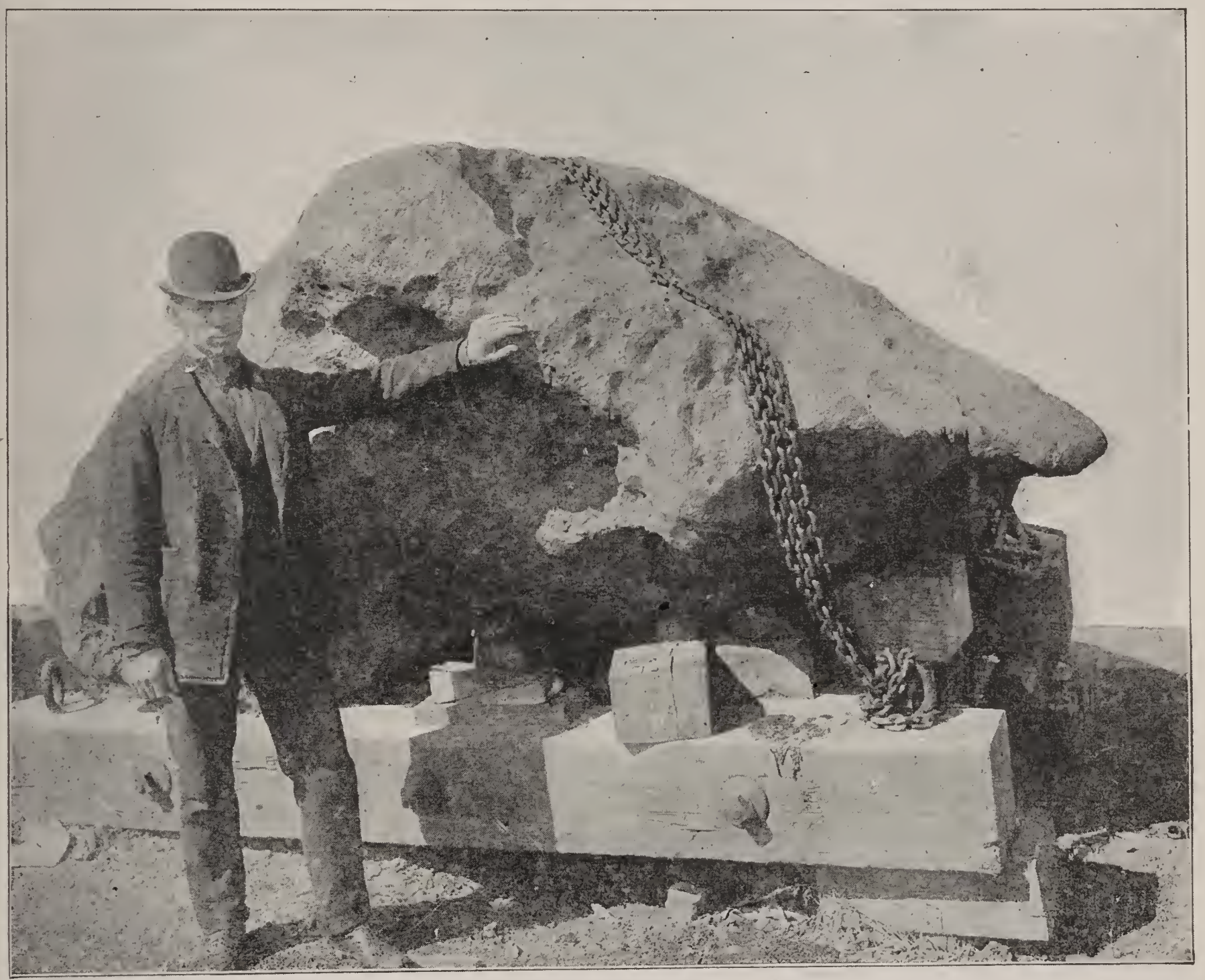
If there are these greater questions relative to the whole universe, there are still as interesting ones regarding the worlds we can behold. The question of whether there are inhabitants on any of the planets is still indeed doubtful. We are not sure yet what bodies have atmospheres about them such as that which makes a part of our earth. The moon has been well studied and with many good results, though they cannot apply to the planets and stars. We can see that she has no atmosphere and that there are traces of mountains and craters of extinct volcanoes, but the largest telescopes made will hardly ever be able to aid us sufficiently to discern these qualities with accuracy on the farther planets. It is said that Mars is inhabited, that Venus turns on an axis and has an atmosphere, though cloudy and not transparent like ours. Mars was for a long time thought to resemble the earth very closely, but after years of study, the only resemblance thought to be accurate is what is supposed to be a cap of snow that appears to form over one of its poles in the Martian winter.

The Sun.

With the sun there are still many questions about which the astronomers are worrying themselves. We know a great deal about this body, but when it comes down to facts, the study is still full of wonders. We should like to know what is the cause and what the nature of the spots on the sun; why the sun seems so

calm when the raging fire that is consuming it is beyond our thought. What is the corona, and has it magnetic properties? And is the hazy patch of light in the sky that follows the counterglow of the sun at its setting in the western horizon the tail of the earth, the same as that to a comet?

It seems wonderful that the astronomers can map out so well the time of the occurrence for eclipses and showers of meteors and the like, and to the one not versed in the wisdom of the science it seems as though there were but little more to learn, but such is far from the case. All calculations are not exact: the earth does not always perform its rotations in the same time; sometimes it is faster, sometimes a little slower, though very slight. For half a century the moon will jump ahead of her regular rate, and then again she will drop behind.



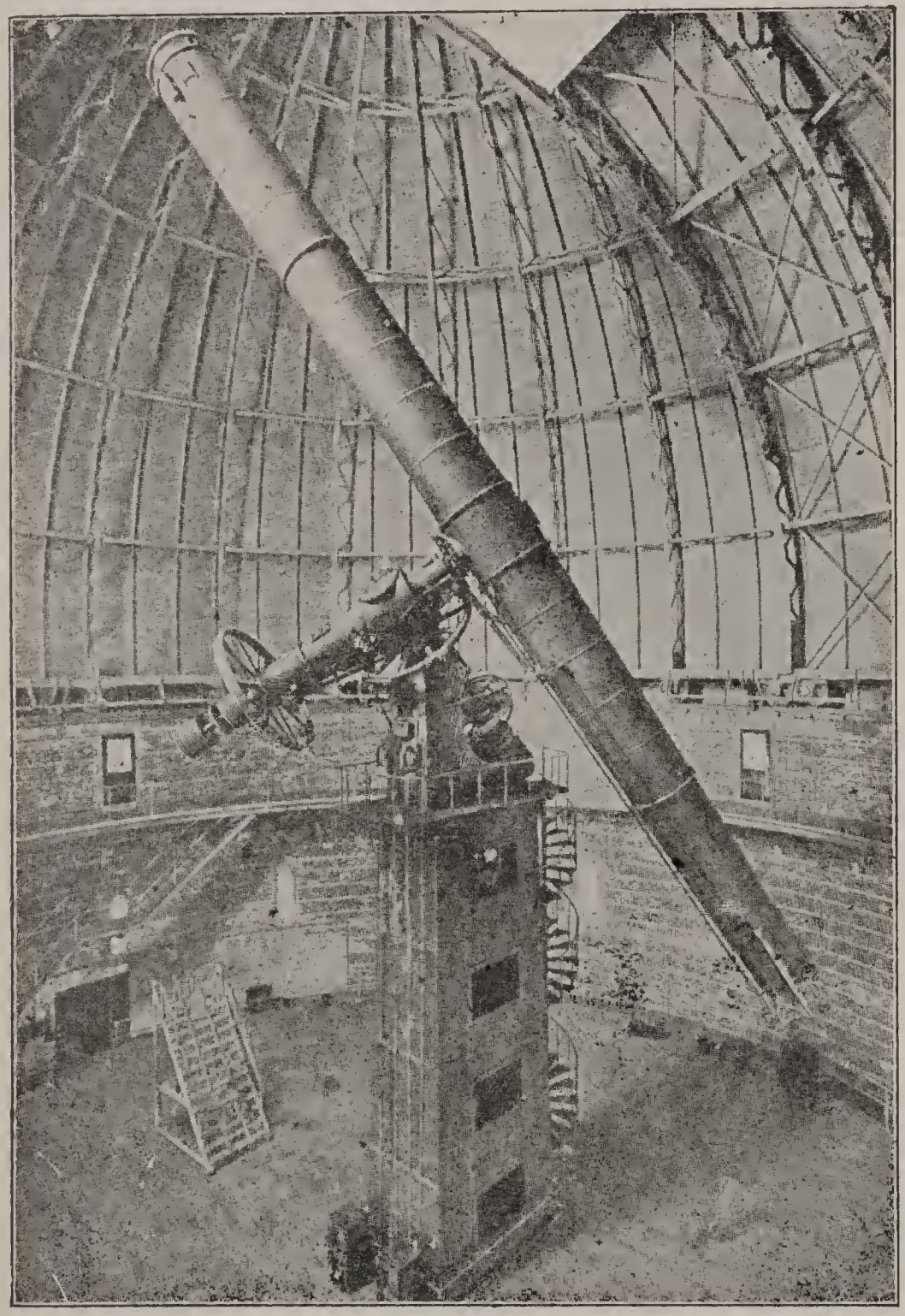
LIEUT. PEARY'S GREAT METEOR "NORTHWARD," THE LARGEST EVER FOUND

Forces Are At Work

here and there that we cannot understand, pulling this planet toward another and vice versa. In all it is a science the most exact and beautiful, but far from finished.

Recent photographs of the moon, taken by means of the elbow telescope at the Paris observatory, have led scientists to believe that the moon has still about it

the remains of what was once an atmosphere. Faint traces of this can be found, and when the shape of the moon shows such a similarity to the earth in the formation of its mountains and craters, ocean-beds and streams of lava, it is thought by some that very likely the same conditions once existed there as do at present upon the earth: hence that the moon was once inhabited. Among the recent discoveries in astronomy the novel assertion is made by Professor See that the color of a star varies with its age, being yellow in its youth, and in its old age blue, the tint being a matter of temperature. The bluer it becomes the hotter it is, because great heat causes blue light-waves. Thus, Sirius is a very blue star, and gives out about one hundred times as much heat as the sun, though only perhaps four times as big. When the sun becomes hotter with age, it is argued, it will be bluer, and we shall have blue instead of nearly white light.



YERKES' TELESCOPE: THE LARGEST AND MOST POWERFUL INSTRUMENT IN THE WORLD.

(Tube sixty-five feet long; lens forty inches wide.)

Interior view of Yerkes Observatory, showing the great "lifting-floor" at its lowest point. By means of electric motors this floor can be brought up even with the eye-piece of the instrument; electric motors also turn the tube and the observatory dome in any desired direction.

The Largest Known Meteor.

Lieutenant Peary, the great arctic explorer, in tramping through Greenland recently found the largest known meteor, which, in honor of his voyage north, he called the "Northward." It contains much iron, and from this substance the native Esquimaux made many knives and fishing implements. It is many times as large as a man, and weighs one hundred tons.

Yerkes' Great Telescope.

With all the studies that are being conducted in astronomy, let us look at a monster telescope by means of which we are brought nearer the starry skies. Charles T. Yerkes, the street-railway king of Chicago and New York, recently gave to the University of Chicago the newest of the great telescopes. In its observatory on the shores of Lake Geneva, near Williams Bay, Wis., it gives to students the opportunity of making the best examinations of the stellar

systems possible. The huge forty-inch lens of the great refractor is the largest in existence, and it probably marks the limit of size to be attained in the manufacture of the instruments, because any larger size might not give so distinct visions, besides being of such great weight that the large steel tube which holds the several lenses would very likely sag and not be accurately steady. The large glasses in the lenses of this telescope were ground by Alvan Clark, who came from a family of lens makers. The glass proper is composed of two lenses, one of crown glass, the other of flint glass, ranging in thickness from three-quarters of an inch to two inches, and placed eight inches apart. They weigh 500 pounds, and were four years in polishing, the final touches being done by the maker's fingertips. Contrary to common thought, dust does not hinder in the use of the telescope, and no protection from it is placed over the glass. Even a small scratch would not greatly hurt the glass, though of course this is avoided with as much care as possible.

The length of the great tube is sixty-five feet, its weight twenty tons, yet the whole instrument is so evenly poised that it can with ease be moved to any angle or position by the hand. Under the ninety-foot dome, where this monster eye is housed, is a large lifting floor of forty tons weight, that can be brought, by means of electric motors, up to a height even with the eye-piece of the telescope. The great dome is also movable, being placed on car wheels which rest on a circular track, and at the will of the operator the whole affair may be revolved about so that the large opening in the roof may be brought opposite any star. The motive power for the dome is electricity, as it also is for the great sliding shutters for the roof of the dome. Inside the base of the tube is a clock-like arrangement that adjusts various parts of its workings, as well as keeps it moving steadily in the path of the star being studied. The total cost of the huge glass and observatory was a half million dollars, but the outlay produced the most perfect seeing apparatus yet devised by man.

A peculiar incident about the history of the glass is that after Alvan Clark, the maker, had superintended the setting of the lens, he returned to his home in Massachusetts and died the next day.

With this instrument many interesting facts are being learned. It has been learned that a layer of carbon, hitherto unknown, surrounds the sun; the fifth satellite of Jupiter, discovered with the Lick telescope, has now been measured by means of the small spider webs drawn across the eye-piece of this new glass. It has also been ascertained that the earth receives a small amount of heat from the stars. Excellent photographs of the moon have been made, and at frequent intervals scientists assemble there from all over the world to make special observations.

Arrangements for photographing with this gigantic camera are numerous. One of the oddest to the uninitiated is that of a set of lenses attached to the outside of the great tube and about forty feet apart. It is naturally supposed that light must be shut off from between the glasses, but such is not the case this time, for all that is wished to be photographed is the object that appears at the focussing point on the eye-piece. Therefore, the only place the light shutter is used is at the end nearest the sky.

A word might be well about the dainty little spider webs used in making measurements with such a telescope. Spiders are kept for the purpose, and in little boxes arranged like lantern slides the webs are strung before the eye-piece, so

that when a star is brought into view a delicate shadow is thrown across its image by these film-like threads. Knowing the space between the meshes of the webs and the distance of the stars, their sizes are computed. These webs are used in preference to any threads that might be manufactured, because of their extremely delicate nature. Another arrangement of interest is a series of colored lights that may be thrown on these webs for telling what the stars are made of. It is well known that certain minerals burn with a certain color, so that by turning on a given light, the light that still shows up from the star can readily be classified and the make-up of the body under observation easily decided.



A MARVELOUS SHOWER OF METEORS

The Great Canals of the World.

PANAMA, NICARAGUA, KEIL, CHICAGO DRAINAGE.

Artificial waterways that will save millions of dollars and make it possible for gigantic ocean vessels to make direct voyages to inland cities and towns which have heretofore been beyond the limits of navigation.

FOR nearly a century after the discovery of America, explorations were made to find the straits that were supposed to exist between the northern and southern halves of the continent. At last, when the Isthmus of Panama was found, engineers at once began to dream of an artificial waterway to link the Atlantic and Pacific oceans. The canal routes that have received the most publicity are those of Panama and Nicaragua. Both of these are under way, though the Panama has expended the more money and is nearer completion. The United States government has interested itself in the Nicaragua plan, and has authorized an expenditure of $115,000,000 on that route.

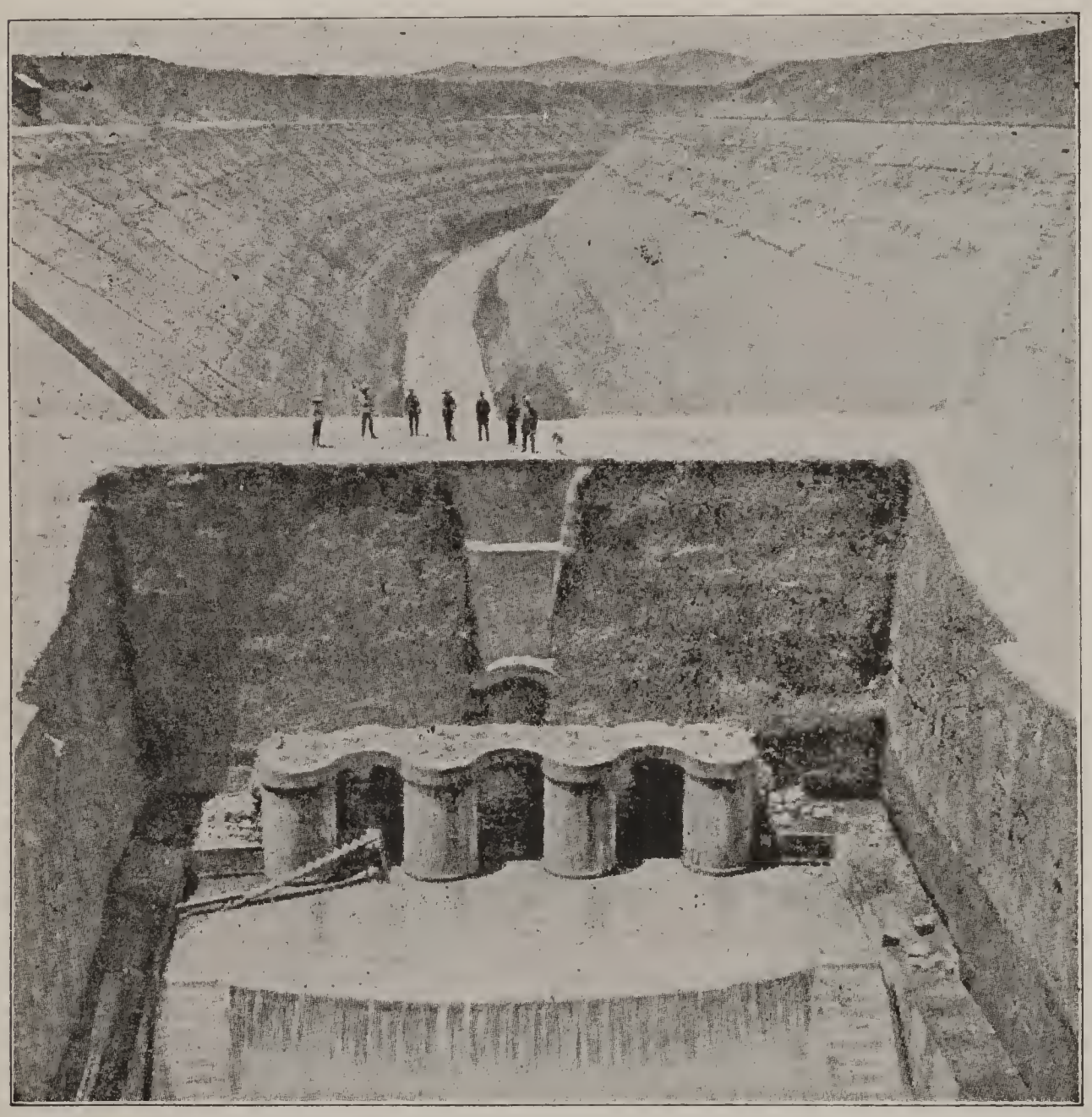
The Panama Route

is already cut two-fifths of the way across the Isthmus from Colon on the Atlantic side to Panama on the Pacific, and the cost of completing it will be about $102,000,000. The route at first lay over twenty-five miles of river, eight miles of the Cordilleras mountains that had to be cut down from 100 to 325 feet, and a great part in bottom lands. Great floods of the Chagres River and the opening up of the damp soil causing sickness necessitated the change of route. Estimates now show $87,000,000 to be necessary for completion, and eight or ten years' time in which to do the work. The route as now laid out is forty-six miles long with the same ports as before, only the Chagres River is not used and in its place canals are to be dug. From Colon fifteen miles is straight cut canal; after that comes a dam which by controlling the waters of the Chagres will flood the country for 13½ miles, with an artificial lake. This lake is to be used as a channel of the canal, and at the other end follows a section of canal five miles long which is the highest of the whole route, sixty-eight feet above the sea. Six locks altogether control the water between the sections, while another artificial lake nine miles north of the main route, caused by another dam, will supply water in dry season.

The Nicaragua Canal,

while well indorsed, is a great deal more difficult task than the Panama, and but a small part of the work has been done. It is to extend from Greytown on the Atlantic, to Brito on the Pacific, using as main channels Lake Nicaragua and the San Juan River. Six locks control the

water, and the hardest part of the plan is to build a series of dams, some of them 6,000 feet long, to check the flow of the San Juan River so that the whole valley will be flooded and make an immense artificial stream connecting with the lake. Short and steep canals are built at each end of the route and connect the lake and river with the oceans. The route is 169 miles long as compared to forty-six on the Panama, while the summit level, or highest point, is 154 miles long, with one end but thirteen miles and the other two miles from the oceans. Should a break occur in one of the Nicaragua locks, half this stretch would be emptied of water and the vessels in transport would be stranded. With both these routes in construction a waterway across the Isthmus is assured before 1910.



OUTLET OF A MODERN CANAL LOCK.

Here is controlled and put to use the enormous power developed by the flow of these great artificial streams.

The Keil Ship Canal.

The great ship canal which is destined to connect the Baltic with the Black Sea, work on which was begun in 1898 by the Russian government, is being pushed forward with the greatest zeal and at the same time with a quietness amounting almost to secrecy. When finished, the work, on account of its immensity and the almost insuperable difficulties to be overcome, will be worthy of a place beside such modern wonders as the St. Gothard Tunnel and the Suez Canal.

The route unites the River Dnieper, which flows into the Black Sea, with the Dwina, which empties into the Baltic Sea at Riga. It starts at Riga, following the course of the Duna River as far as Duneberg, where it is united to the Beresina by means of an immense course cut right through the country. The Beresina and the Dnieper are then used to complete the connection. The total length of the line is 1,600 kilometers, or about 1,000 English miles, 200 kilometers of the entire distance being artificially cut through the land. The work is to be finished in

five years, if all goes well and a sufficient number of men are kept at work during that period.

The canal is about 307 feet wide, and about thirty feet deep, thus allowing the largest vessels means of passing from one sea to the other. Seventeen large ports, or artificial bays, are to be constructed along the line as well, each capable of containing a large number of ships, so that a Russian vessel, however large it may be, may make the entire transit in six days without hindrance of any kind.

The Cost

of the work, at the lowest estimate, and taking into consideration the means at the disposal of the Russian government as to the adoption of unpaid labor, will amount to about $120,000,000. The whole passage is kept within the limits of the Russian Empire, thus allowing Russia absolute sovereignty over the entire course. Putting aside the great political advantages given to Russia by the new enterprise, the gain commercially and economically will be an incalculable one.

Chicago Drainage Canal.

One of the greatest enterprises in the line of canal building has just been finished by the Sanitary District of Chicago, and consists of an artificial waterway connecting the waters of the Chicago River with those of the Mississippi. For years the filth of the Chicago River has been such as to give the stream the name of "sewer." The refuse from numerous factories emptied into it, and in heavy weather or after a thaw these waters flowed far out into Lake Michigan, from which Chicago gets its water supply, thus being a great menace to the health of the inhabitants. The opening of this canal effectually turned back the waters of the river from its mouth and made the stream flow towards its source. Virtually Lake Michigan thus has an outlet to the Gulf of Mexico, the water flowing steadily up the river and out through the cut that joins the river at its south branch, and over a rocky bed and between stone walls to Lockport, Illinois, where a great controlling dam is situated that lets the water into the Des Plaines River. From this point the water runs by way of the Des Plaines, through the town of Joliet, to the Illinois River, and thence into the Mississippi. The canal is 160 feet wide, is made of six-foot thick masonry, and is deep enough to admit ocean vessels, while it has a capacity of 600,000 cubic feet of water a minute. Part of the route lay along clay beds, and here the work of construction was the easiest; elsewhere it lay along solid rock, and here blasting had to be done; another part lay along a prairie, and there a wall of stone thirteen miles long had to be built.

To remedy the sewage problem of Chicago the whole sewer system had to be reversed, and the refuse matter made to flow out to the canal instead of into the lake as heretofore. To do this large intercepting sewers were constructed underground, connecting the larger sewer mains and emptying into the south branch of the river. It took seven years to construct the canal, and about $32,000,000 were expended. The money for this was raised by taxes, but a large income will be derived from the use of the power developed by the fall of the water over the dam at the big controlling works at Lockport.

The Stupendous Power of Niagara Falls.

FIFTY THOUSAND HORSE POWER DEVELOPED FROM THE WORLD'S GREATEST CATARACT.

THE Niagara Falls are now being used to operate great electric dynamos for generating power for many factories in their neighborhood. The waters of lakes Superior, Michigan, Huron and Erie empty into the Niagara River, which after leaving Lake Erie flows swiftly for two miles and then widens and separates above Grand Island into two branches. These come together again below the island, and flow slowly about several islands till their combined waters reach the "rapids" about a mile above the falls. The flow of water here is 275,000 cubic feet a second, or half a million tons per minute. This enormous flood was first utilized for power in 1725, when a small saw-mill was erected near the falls and run by its force.

The Niagara Falls Power Company recently made cuts in the river a mile above the American Falls. Water is led in from the "rapids" by a canal 12 feet wide and 180 feet long, with capacity of 100,000 horse power, to a wheel pit 30 feet wide by 200 feet long and 180 feet deep. Eight steel penstocks restrain the water in its plunge down to the bottom of the wheel pit, and at the base of each is a 5,500-horse power vertical turbine. The shaft of each turbine is attached at the upper end to a 5,000-horse power generator, which gives the plant a total capacity of

40,000 Horse Power.

Provision has been made for two more turbines and for another house to be built on the Canadian side. From the wheel pit the water runs through a tail-race 7,000 feet long directly under the town of Niagara Falls to an outlet at the base of the cliffs.

The Niagara Falls Paper Company uses 7,200 hydraulic horse power from this same point, taking it from the canal before it reaches the penstock.

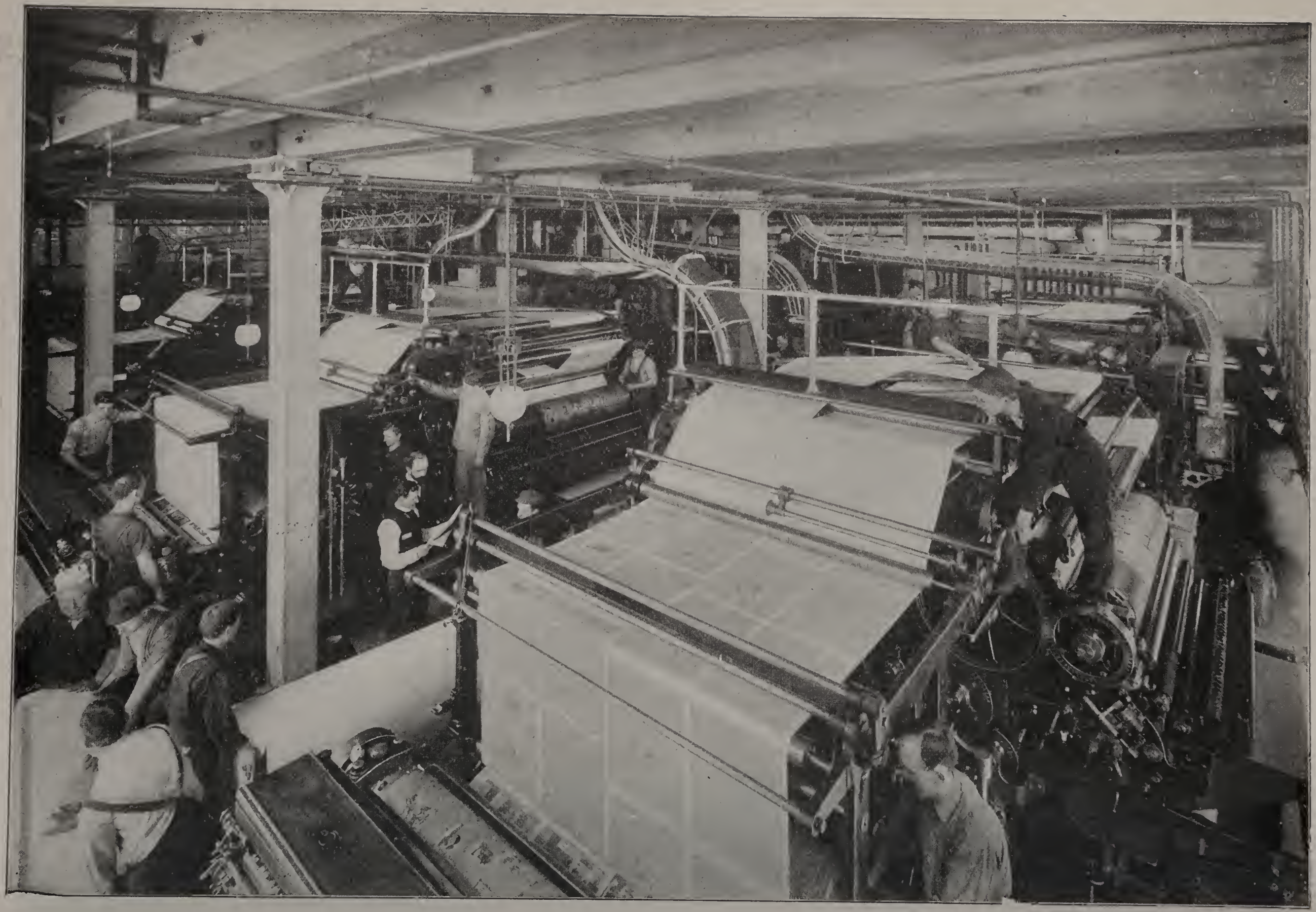
Another plant, operated by the Niagara Falls Hydraulic Power Company, takes in water from the rapids 2,000 feet below the other intake, and runs a canal through the town to the edge of the gorge, where two penstocks, eight and eleven feet in diameter, take the water to a power house 200 feet below at the edge of the river. Here horizontal turbines develop energy to about 20,000 horse power. An old canal built in 1858 also supplies about 7,500 horse power. On the Canadian side the Niagara Falls Park and River Railway operates a power house with two turbines, and generates 2,000 horse power.

The theoretical power that is possible from the Falls is that of 7,500,000 horses, of which, however, less than 50,000 is being developed and put to useful account.



THE LINOTYPE AND "MAKEUP-ROOM" OF A GREAT DAILY NEWSPAPER

IN THE BACKGROUND ARE SEEN THE LINOTYPE OR TYPESETTING MACHINES AND THEIR OPERATORS. IN THE FOREGROUND TO THE RIGHT ARE THE TYPESET PAGES OR "FORMS" OF THE PAPER



THE HOE QUADRUPLE PRESSES IN THE PRINTING OFFICE OF A LARGE DAILY NEWSPAPER

TO THE LEFT ARE HUGE ROLLS OF PAPER READY FOR USE. IN THE CENTRE-FOREGROUND IS SEEN A PRINTED PAPER COMING FROM THE PRESS, FROM EACH PRESS CURVING UPWARD THROUGH THE CEILING, ARE TROLLEYS FILLED WITH PAPERS READY FOR DISTRIBUTION



STUDENTS OF DECORATIVE PAINTING AT WORK—SCHOOL OF INDUSTRIAL ART, PHILADELPHIA.



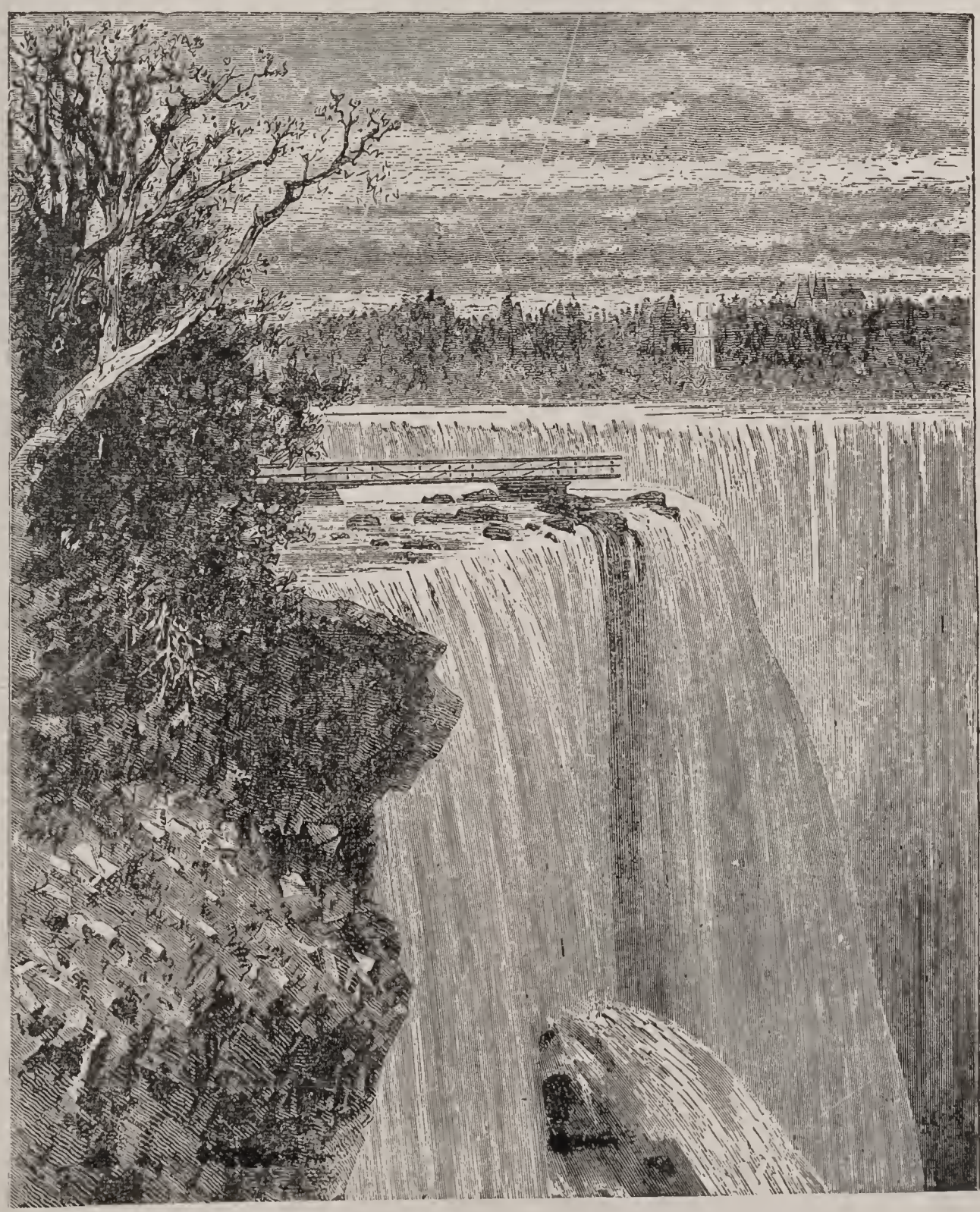
THE YERKES OBSERVATORY ON THE BLUFFS NEAR LAKE GENEVA, WIS.

IT IS CONNECTED WITH THE ASTRONOMICAL DEPARTMENT OF THE CHICAGO UNIVERSITY, AND CONTAINS ONE OF THE GREATEST TELESCOPES IN THE WORLD, DONATED TO THE UNIVERSITY BY CHARLES T. YERKES, AT A COST OF OVER HALF A MILLION DOLLARS

The Turbines

that do the work of generating power are arranged in pairs. Each is attached to a 13-foot diameter inlet tube. Two large revolving bronze wheels receive the water, which has first been governed by pressure gates, and led into the wheels by draught tubes, which are so arranged as to keep the dampness out of the machinery. The turbines are 70 inches in diameter, and have 36 blades, each one of 142 square inches and highly polished so as not to give resistance to the water. The axis of each of the great wheels is 11½ inches in diameter, and they are all mounted on ball bearings. Each turbine revolves 250 times a minute.

Industries using electric power for manufacturing paper, aluminum, carborundum, calcium carbide, and other chemical industries, street railways of Niagara and a railway of twenty-two miles to Buffalo, are all being operated by this great power generator. Buffalo alone takes 6,000 horse power. It was at first thought that the electricity thus generated would sometime be taken great distances for power purposes, but the tendency is more for industries to move near Niagara than to transmit the power



THE WORLD-RENOWNED NIAGARA FALLS

The Cinematograph—Moving Pictures.

Reproducing, by means of the camera, the motion of moving objects as well as the objects themselves. A wonderful accomplishment which science in the time of our fathers would have scoffed at as impossible,—to-day an absolute fact.

TO THE person viewing for the first time the flitting pictures projected from a moving-picture machine to the large magic-lantern screen where they reproduce accurately every phase of life in rapid motion, there is something very weird and fascinating. When one knows, however, the means by which this extremely odd and interesting feat is accomplished, he simply learns that another great improvement has come about in this age of invention.

The first phase of the moving-picture study was that of the invention of the

"Zeotrope."

This was a toy in the shape of a wheel-like disk. On the back were painted a number of figures, each one in a stage of motion a little farther advanced than the one before it. Under each picture was a narrow slit, so that when a pin was run through the center of the disk and the picture side of the zeotrope held nearest a mirror, the person using the toy might squint through the slits as they passed by when the disk was whirled around. The general effect thus seen through the slits reflected on the glass was that of the object going forward by jumps, a great deal like real life. Since the artist had to draw upon his imagination in painting the pictures, they were often incorrect in attitude, therefore as the disk spun around some very grotesque methods of locomotion were the result.

This, however, was but the start of a series of experiments which later brought to perfection the present motion pictures. Some years later there appeared an invention which brought to light the main principle now used in the best machines, namely, the passing of a strip of pictures behind the lens of a lantern, the device having a shutter which cut off the light for a short interval, as a new picture was moving into place, and again opened to allow the passage of light as the picture paused an instant before the lens. All experiments have since been conducted upon this system of jerking pictures through on strips, letting them pause for a moment before the light, then shutting off the light and then again going through the same operation.

The question now came as to how correct pictures might be obtained to place on these strips. When instantaneous photography became a fact, a man named Muybridge, of California, tried the scheme of placing a number of cameras in a row

along a road where he trotted a horse, and as the horse was in front of each camera the respective shutters were set off automatically. The result was his famous "Trotting Horse," which for some time astonished the public in its lifelike motions. But it is apparent that the cameras had to be placed so far apart that the jump from one picture to the next was too great, especially if the machine reproducing the pictures was moved very rapidly.

The Kinetoscope.

Then came Edison with his famous kinetoscope, by which he took series of photographs on long strips of film at the rate of some thirty a second. After this process the rest of the work of perfection was simply that of mechanical contrivances, the principle remaining the same.

The systems in all the different motion-picture machines are very similar, though there are nearly as many names as machines. First, photographic films are prepared on strips of gelatine, varying in length from seventy feet to six hundred feet. These strips are sensitized the same as a photographic plate, and are wound in convenient spools. The object is to pass this strip of film through a camera at the point where the plate is usually placed, or the focal point, unwind the roll bit by bit, have a tiny section an inch long stop still in front of the lens of the camera for a short fraction of a second, then have a shutter cut off the light, and the roll proceed till the next inch is before the lens. When the light is on again, another exposure is made, and so on till the whole strip of film is used up and about a thousand pictures have been made, all in the space of a little over a minute. This process requires a delicate mechanism, for the film must stop before the lens just during that fraction of a second that the shutter is open, and the shutter must remain closed while the next bit of film is moving into place.

After a series of pictures have been exposed, the strip of film is taken to the dark-room and developed. To handle a roll of flimsy gelatine seventy, a hundred, or perhaps several hundred feet in length is no small task, but devices have been arranged for keeping it on a windlass and unwinding and developing a short length at a time, or winding it on frames with pegs on them, so that the whole piece can be developed at one time. After the film is dried another film is placed over it and another exposure is made, only this one is a positive, whereas the other was a negative,—that is, in the negative all the white objects were black, and the black objects white, but in the positive they are their proper colors. Now, after the positive has been dried, it is ready to be passed again through the machine, which is, however, this time fitted with a powerful light of some kind, similar to that in a magic lantern. The film is unwound and the shadow is cast by the light through the lens upon the white screen; then the shutter cuts off the light, the next picture moves into place, and the light throws another picture. The pictures move about fifteen to the second, that is, almost the same as the animal moves in real life. By a peculiar phenomenon, called "persistence of vision," we retain upon the retina of the eye the image of what we have seen for even a short fraction of a second after we have shut our eyes, or the light has been cut off. This may be explained by looking through the fly-wheel of some large engine. The spokes keep cutting off the vision, yet the only result is a haze over the object beyond. Well, this is what enables us to view these motion pictures, for as we gaze at one picture it becomes firmly impressed

upon the retina of the eye, and stays there long enough for the next picture to be moved into place. Thus we experience the effect of a continuous motion instead of a series of pictures, though there is a jerky sensation that it will take some time before the inventors can do away with.

Pictures may be colored and made more lifelike, though this is not often done. As yet these motion pictures have not been placed to much use beyond that of amusement. It is helping in some studies, however, such as that of anatomy. Pictures of operations may be made and afterwards shown to the class. At present we have all sorts of subjects, from athletic contests to naval and land battles; from scenes in the nursery to the flight of birds or the thundering advance of the fast locomotive.

The White Man's Greed for the Land of the Blacks.

CIVILIZATION IN AFRICA.

THE scramble for land in Africa by the nations of Europe is of comparatively recent date. Earliest explorations were begun in 1553, and while the continent has held more of romance and danger for the explorer than possibly any other, it has been a hard task to colonize it. France and England, as in other things, have been constant rivals here, with England in the lead. Country after country has pushed into the interior at different points along the coast, and gained control of the native chiefs. Generally the partition went on gradually and peacefully, and it was not till after the Brussels Conference in 1878 that the unrestrained scramble began that has since resulted in the division of the whole continent among the great powers. In 1876, while Great Britain, France, Spain and Portugal had located colonies on the coast, the interior was largely held by wild tribes, but since then the work of division has been so energetic, that in 1890, of the 11,900,000 square miles of territory on the continent, only some 1,500,000 remained open for further conquest. Conflicting claims have existed all along between the powers, and it was through these mainly that France had trouble with England at Fashoda, in which the latter country came out victorious, and which keeps England's army in the Soudan. The recent trouble with the Boers in South Africa will very likely add to the possessions of Great Britain, while France is daily getting a stronger hold on Madagascar. The following is the area as controlled by the different powers, omitting such as has over it only a protectorate government: Great Britain, 2,250,000 square miles; France, 3,500,000; Germany, 890,000; Portugal, 900,000; Italy, 600,000; and Spain, 250,000. Besides these possessions there, the Congo Free State controls 850,000 square miles; Liberia, 37,000; the Boer republics, 162,640, and unappropriated territory, 1,500,000

Scientific Farming.

FOREST WASTE: IRRIGATION: PREVENTION OF FROSTS:

Congress investigating and assisting in agricultural expansion, making it possible to grow grains and fruits in what was formerly a barren waste.

YEAR by year the United States government is striving to aid the farmer and land-owner by scientific work through the Agricultural Department. One of the greatest problems before the department, and before the whole country in fact, is the waste of timber, the denudation of forest land and the resulting floods that ravish the countryside in the spring, only to be followed by long droughts in the hot season. The making of paper is of course a necessity, but the rate at which timber cutting is going on for building and for making paper pulp is astounding. The people of Maine have complained, but they are not the only ones who are becoming anxious over the depletion of our great forest lands. The devastation is enormous, and the waste is equal almost to the amount used. A substitute is desired for paper pulp, and the Legislatures are taking up the question. Cornstalks have been used with some success, and some relief seems in sight.

Congress, in the fall of 1899, sent a

Commission to the Head-Waters of the Mississippi

which looked over the ground in Minnesota for the purpose of establishing a national forest reserve and game park. The possibility that the vast cuttings of timber at the head of these waters might threaten this mighty stream has caused this action of Congress. The forests keep the moisture under their roots and allow it gradually to seep through continuously in all seasons. When trees are cut down it leaves a barren tract of land, over which in rainy seasons the waters pour in gullies to the rivers. Disastrous floods follow, but as soon as the rain ceases, as harmful droughts take their place.

While forestry has become a living issue in the fertile Atlantic and Northern States through the depletion of perennially flowing springs and streams and increased flood action, and probably by greater and increasingly injurious extremes of frost and heat arising from forest destruction, in the West and Southwest successful forestry is to be the saving of the country. Vast stretches of arid land await development, and what good timber land there is will be saved at all hazards. The covering of the mountain sides must be respected, though of course old trees may be cut as young ones grow up.

Another method for

Reclaiming the Bad Lands

is to find crops that will grow in arid soil. Brome grass and broom-corn millet are

being tried with great success. This possibly is an easier way for the individual farmer than irrigation ditches. After fairly good crops of these grasses are raised for some time, the conditions naturally improve greatly. In many cases springs are developed, the grass sod holding the water in the hillsides.

Another method for helping the agriculturist is through the Weather Bureau. Daily signals are sent all over the country warning against approaching storms. It is the study of this department to avoid as much as possible the bad effect of drought and flood, and particularly of frost.

The most effective prevention against



A CALIFORNIA JACK-RABBIT DRIVE—RABBITS ENTERING CORRAL.

In the west the country is so infested with jack-rabbits that the whole community rises to drive the pests in an ever-narrowing circle that at last ends in a corral. Here they are leisurely shot or killed with clubs.

Kaffir corn is an example of what can be done in this line. Ten years ago this plant was an experiment in the United States. It was said to thrive in ground too dry for Indian corn, and was tested in western Kansas. In 1898 Kansas raised corn of this kind to the value of $5,688,380,—a reclamation of half a million acres of land in a single State.

heat radiation that induces frost is by means of glass screens, which possess the peculiar properties of allowing the heat to come in from the sun, but are almost impervious to the "dark" heat rays reflected from the earth and plants. Lately, in California, muslin screens stretched on poles above the tops of the trees have protected whole orchards. In

Florida, houses of laths are made with openings at the top the width of a slat. When placed in the proper direction so as to receive the sun but gradually in the morning, the fruit trees thrive, for at night only partial radiation of heat takes place. Sometimes crude petroleum or tar is burned near the trees, so that great clouds of smoke are produced that rival atmospheric clouds. This produces conditions that will not allow frost. To quote Professor Garriot of the Weather Bureau, "The amount of heat produced from burning one sack of wet straw weighing fifty pounds, and condensing water vapor near the earth, would be sufficient to raise the temperature twenty degrees in a space of seventy-five feet square and twenty-five feet high. If only one quarter of this heat remained within the region to be protected, which would seem to be a reasonable estimate, it would afford ample protection for almost any ordinary conditions."

Spraying and Sprinkling Plants

has been effectual in preventing frosts. In California, during threatening seasons, sprinklers are placed at the top of fifty-foot poles, which fill the air with fine mist. The owners of the ranch using these claim they have proved very successful in saving crops. In France frost bells are rung to warn the vine growers when frost is expected, and they immediately pour tar on the ground near the vines and set fire to it. In Louisiana and Florida water ditches are run between rows of trees. During threatening weather the water gives off heat as it passes along, thus warming the surrounding atmosphere and saving severe freezes.



THE BUCKEYE MOWER AT WORK

DISCOVERIES IN THE ART OF HEALING

THAT HAVE REVOLUTIONIZED MEDICINE.

Curing by Light Rays; Artificial Skin and Bone, Germicide, Etc.

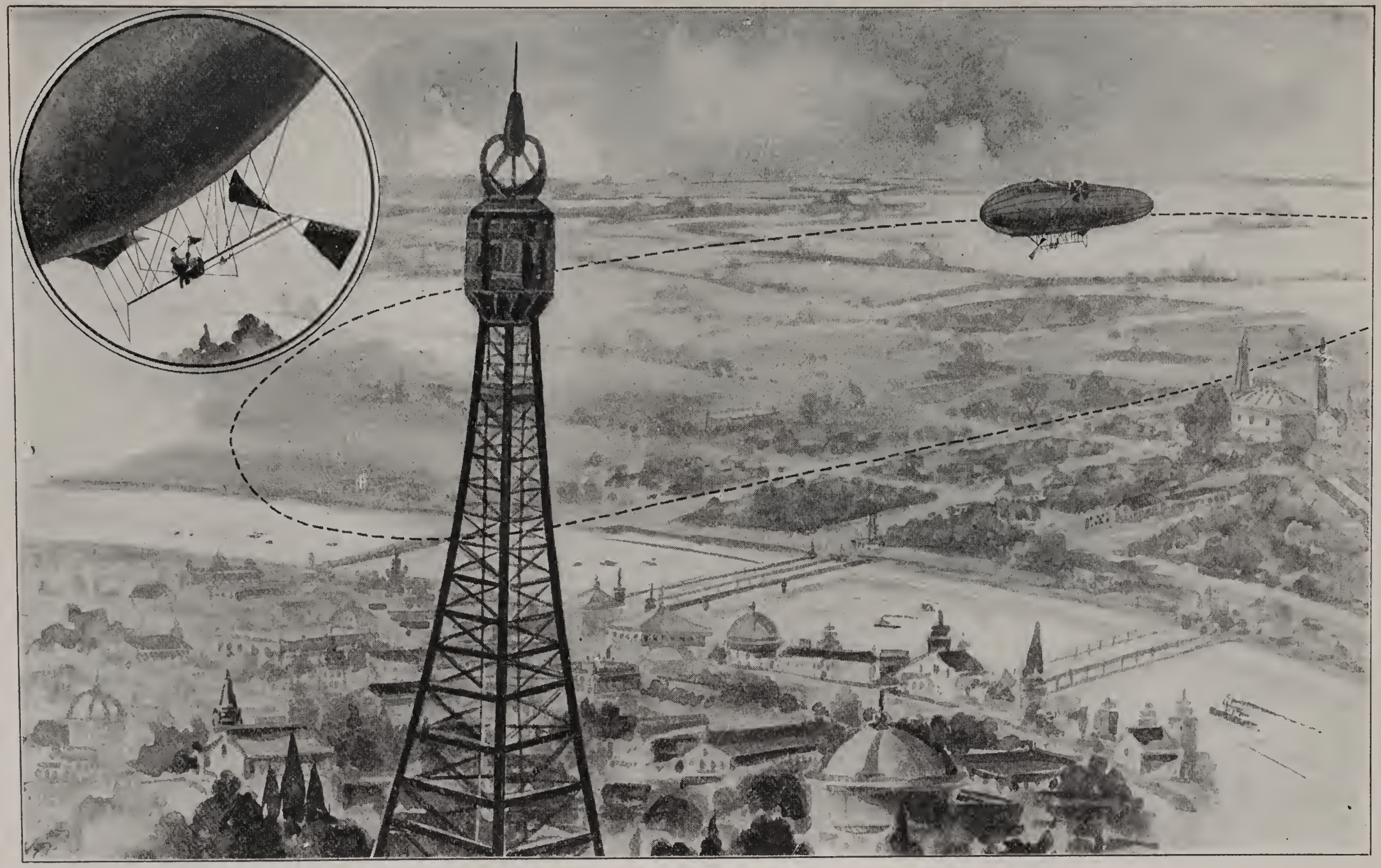
MANY diseases and injuries which a few years ago were considered incurable and always resulted in death are to day successfully treated by the masters of medical science. Thousands of persons to-day owe their lives and healthy phys ical condition to the last decade's progress in surgery.

With the recent experiments in treatments for disease by electricity, X-rays, the Finsen violet light, and Pasteur serums for plague microbes, the world of science is fast advancing upon the diseases that flesh is heir to. Most scientists are coming around to the belief that a vast number of ailments commonly attributed to various or unknown causes all have their origin in microbes or bacilli,—tiny animal natures that feast themselves upon the tissues of the human body. With this thought in view, they have steadily sought out the particular germs of certain diseases, with the result that many have been classified The next study was to find some remedy that would effectually chase these intruders out of the system. At present scores of microbes have been found, some that cause one disease, others that cause others. Thus tuberculosis, or consumption of the lungs, diphtheria, plagues, cancers, and yellow fever, each has its own peculiar bacillus, and physicians are daily searching for more and surer enemies to these little pests.

Light in almost any form and pure air are very beneficial in these diseases, being deadly enemies to most microbic organisms. Consequently scientists are searching through these media for the desired remedies, and yet in some cases air on a sore surface aggravates the trouble. Dr. Murphy has recently invented a process for the treatment for consumption in which he pierces one lung by means of a small hollow needle. Through the aperture of the needle he admits a quantity of gas which collapses that lung in its diseased part. When the tissues of the lung come together they scarify or grow into one piece, and though the lung is smaller than at first, it is cured; and after a few years the constant exercise of the lungs tends to develop them to their former size Dr. Murphy was also the inventor of the famous "Murphy button" for piecing together severed intestines.

Cures by Liquid Air.

Liquid air, though in its crude stages for surgical uses, is yet hailed as a great boon to man. There is not to be found any other means of producing such intense cold, and the effect upon animal tissue of this strange property of air is nearly the same as intense heat, though no blister is occasioned. In cauterizing wounds, in removing foreign growths and killing putrid flesh, this method is sure and has few evil after effects. It



M. SANTOS-DUMONT'S FAMOUS AIRSHIP

THE ENGRAVING SHOWS THE AIRSHIP SAILING ROUND THE EIFEL TOWER IN PARIS AT A HEIGHT OF 700 FEET. THE LENGTH OF THE AIRSHIP IS 103 FEET; DIAMETER, 11 FEET; PROPELLOR SCREW OF 16 HORSE-POWER MAKING 200 REVOLUTIONS A MINUTE

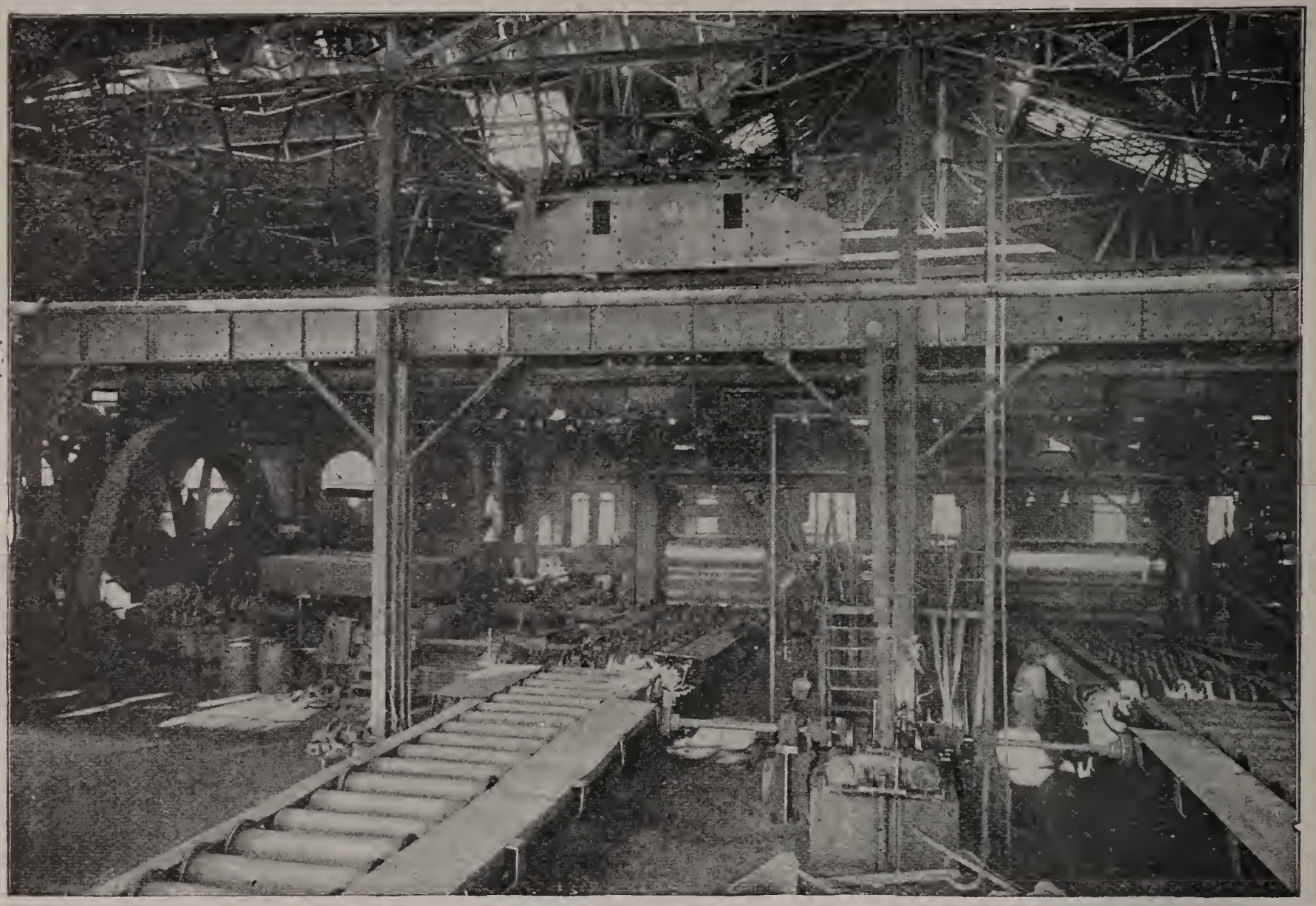


WINTER RECREATION AND PLEASURE



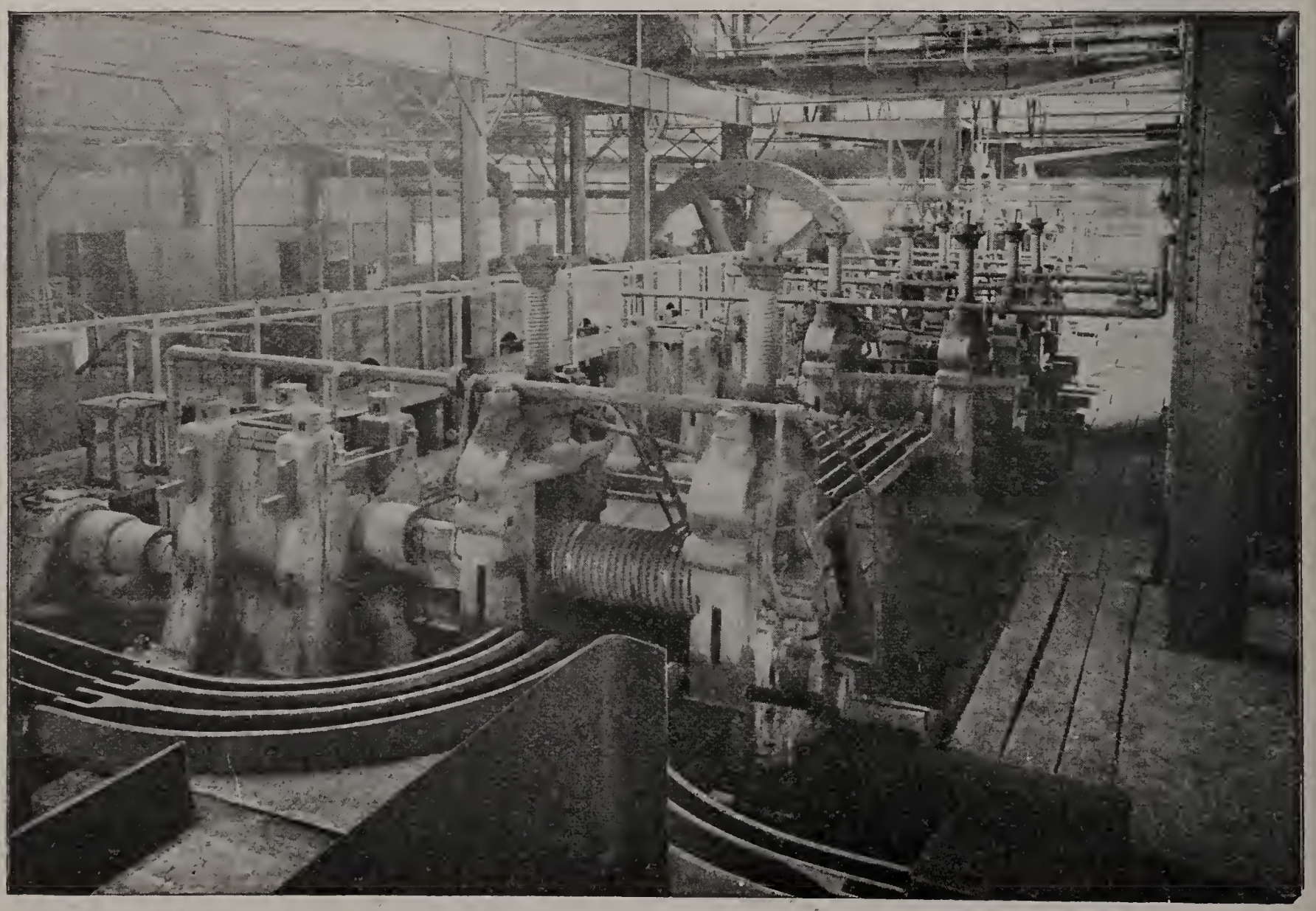
UNION STOCK YARDS—CHICAGO

SHOWING THE CATTLE IN THE PENS, IMMENSE SHEDS AND PACKING HOUSES. THE NUMBER OF CARS REQUIRED IN A YEAR TO BRING THE STOCK TO THESE YARDS WOULD MAKE A TRAIN THREE HUNDRED MILES LONG



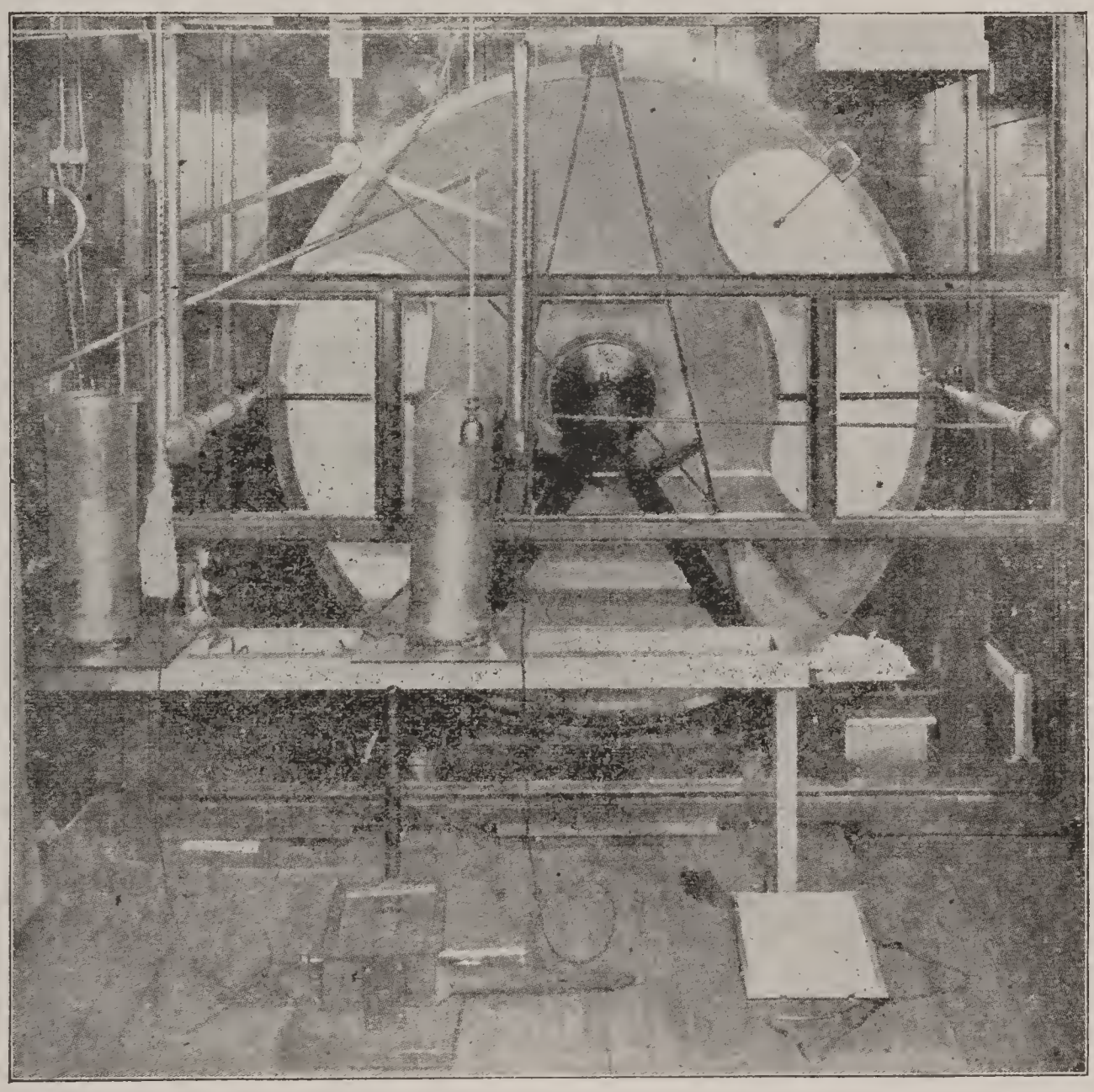
STEEL PLATE MILL

SHOWING IN THE BACKGROUND THE IMMENSE ROLLERS THAT PRESS THE WHITE-HOT STEEL INGOTS OR SLABS INTO IMMENSE STEEL PLATES FOR THE HULLS OF VESSELS, LOCOMOTIVES AND OTHER USES



CONTINUOUS TRAIN-ROD MILL SHOWING THE IMMENSE ROLLER THAT PRESS THE IRON INTO LONG RODS

cures corns, warts, boils, ring-worms, ivy-poisoning and ulcers, forms of rheumatism and neuralgia, kills typhoid fever germs, as well as diphtheria, and in part supplants the surgical knife. It has been used with success for eating out ulcers, and recently a case of facial erysipelas was treated by rolling a glass bulb filled with liquid air over the inflamed tissues, with the result that the heat subsided and the patient was entirely recovered.



A HUGE STATIC ELECTRICAL MACHINE FOR X-RAY WORK.

Diameter of revolving plate, 6 feet; of fixed plate, 6 feet 4 inches.

Finsen Light Cure.

Probably one of the greatest discoveries of recent years in medicine has been that of Dr. Finsen of Copenhagen for the cure of skin disease by subjecting the affected parts to strong violet rays of light. It is well known that such maladies are caused by bacteria, and when light in concentrated violet hues is cast upon diseased tissue it has been found that the bacilli are killed and the skin becomes healthy again.

The bactericidal property of light had previously been proved. Investigations at the Finsen Laboratory showed that that property, instead of residing in light as a whole, was peculiar to the chemical rays. These rays have a power to irritate the skin and to penetrate it. He exposed a specimen bacillus to bright sunshine in July, and found that the rays killed it in an hour and a half. The light from an electric lamp did the same work in about eight hours. It was learned that when

the skin was full of blood it was harder for the light to penetrate. This was proved by fastening a piece of sensitized photographic paper behind a man's ear and placing him in the sunlight. After a considerable exposure the paper was unaffected. When the ear was afterwards pressed so as to squeeze the blood from it an exposure of twenty seconds turned the paper black.

Now, as soon as Finsen had learned that the blue rays of light had the properties of killing disease germs, he set about devising a method for its practical use. The result has been a set of lenses between which is a bright blue, weak, ammoniacal solution of copper sulphate. This water absorbs the red or heat waves and some of the yellow, but allows the blue, violet and ultra-violet rays to pass. To the surface of the skin to be treated is attached by rubber bands a lens between the glasses of which is run a stream of water to cool the surface and keep from blistering the skin, while at the same time the weight of the glass presses out most of the blood. When the rays are turned on, they at once penetrate to the spot where the germs are feeding upon the tissue and destroy them. It is said the treatment has been very efficient in smallpox, lupus or tuberculosis of the skin, baldness in small spots, and other epidermic ailments, and the patients say there is little or no pain, and are quite ready to undergo the treatment.

Pasteur Serum.

M. Pasteur of Paris, the inventor of the Pasteur water filter, and discoverer of hydrophobia serum, has recently been giving his attention to other methods for bacteria killing. In Portugal recently the plague broke out in a most frightful manner, and daily took off scores of victims. At Oporto all experiments with the Pasteur serum were completely successful, and in China, where the plague seemed to originate, cases have been reported where life was saved. The work, however, is extremely difficult, since the natives are very suspicious of the French and English doctors. The treatment consists of injection into the blood of serum prepared especially for its deadly effects upon the plague bacilli. When the treatment is undergone in time, it is rare that the patient is not saved.

In the Pasteur institute for rabies in Paris all the persons treated in 1898 were cured with the exception of three. For the thirteen years since the foundation of the institute to the end of 1898, 13,183 persons were treated in Paris, and out of this number only ninety-nine died.

Anti-Toxin.

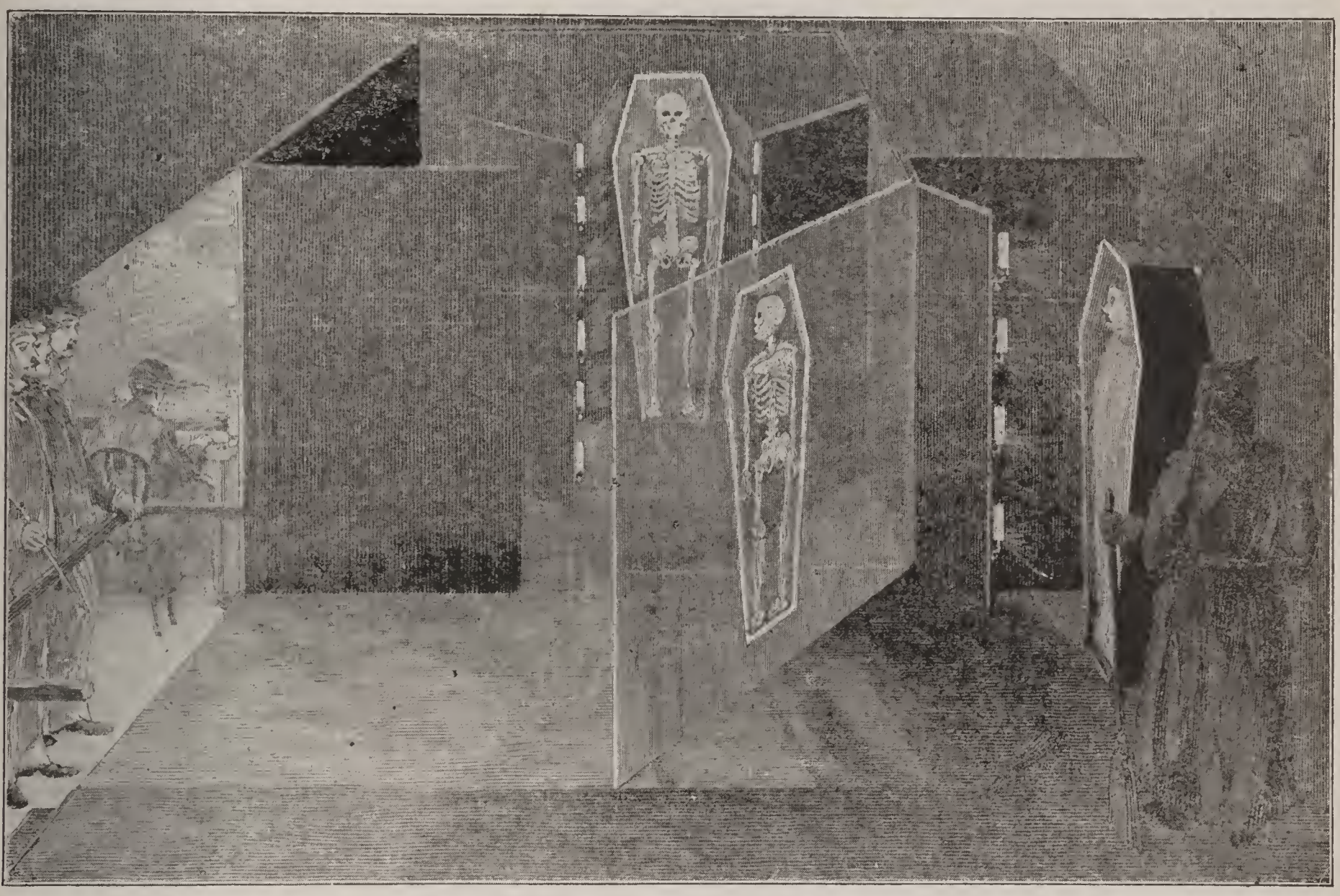
A serum called anti-toxin has recently been put into use as a cure for diphtheria. It is a brownish liquid prepared from the serum taken from the glands in the neck of a horse inoculated with the disease to fever point. The serum is allowed to stand and the anti-toxin comes to the surface and is skimmed off. By injecting the anti-toxin into the blood of the subject there is at once sent through the system a most deadly enemy to the diphtheria germs. One well-known physician in two years' practice with this remedy treated 2,100 cases in malignant form without losing one patient. The after effects are somewhat weakening, however, as the action of the anti-toxin tends to retard the heart's motions.

The X-Ray.

Brain specialists have hailed with joy the X-ray as a medium for learning whether clots of blood are pressing on certain parts of the brain, thereby causing insanity, or inaction of some of the facul-

ties. One well-known lawyer in a fight with burglars received a severe blow on the head which rendered him insane at times. By means of a skiagraph or X-ray picture a shadow was seen that indicated a pressure on one of the brain convolutions. A cleft was made in the skull, the pressure removed, small bone particles placed over the cleft and the skin replaced. Apparently the lawyer's reason was restored.

In stomach diseases it has been very difficult to locate enlargements or to indicate conditions of the membranes. Recently saturated chemical solutions impervious to the X-rays have been poured into the stomach, and skiagraphs taken which resulted in remarkable discoveries. Other uses for these rays are constantly coming before the public Some time ago a Chicagoan suffered great agony from what seemed to be an abscess behind the base of the nose. By means of the Roentgen rays a skiagraph showed that the sufferer had in the cavity back of his nose a small sack containing thirty-two miniature teeth. An operation was performed successfully, but for which the patient might have died. It is hinted that mental conditions are expected to be discovered by the aid of this remarkable light, certainly nearly every other malady has been treated with a measure of success. The heart can be seen beating in



A SO-CALLED X-RAY EXHIBITION.

A reflection from the man in the coffin appears on the screen at the same spot that the reflection from a skeleton in the coffin is seen at the back of illustration. By turning on one set of lights and lowering the other, the man appears to be transformed into a skeleton, and the skeleton into a man, at the will of the operator.

one's breast, and enlargements or diseases can be promptly treated. Consumption of the lungs is discernible before it reaches its last stages, and ruptures, fractures and the presence of foreign substances can at once be noted.

Apart from medical use the X-ray was recently employed to explore the interior of a mummy casket that had never been opened since the time some old Egyptian Pharaoh had been wrapped in his burial clothes. Also mummified animals, so dried up that the family to which they belonged could not be ascertained, were easily classified after skiagraphs had been made of their bones and skulls.

Hydrophobia.

Because of the apparent cruelty of the Pasteur treatment for prevention of hydrophobia, resulting from inoculation of small animals like the rabbit with rabies in order to procure the virus necessary to inject into the patient, many scientists have been studying other methods for curing or preventing this frightful malady, with the result that the Buisson system has quite a following. Many persons imagine yet that M. Pasteur undertakes to cure hydrophobia; this is a mistake, for from the point of view of this school of scientists, the disease is incurable; the only thing they claim for their treatment is that it would prevent rabies if given soon enough after the bite. This was considered weak by many physicians, and though the Pasteur institutes have been in a wonderful degree successful, the followers of the Buisson method assert that theirs is the more simple, humane and curative system.

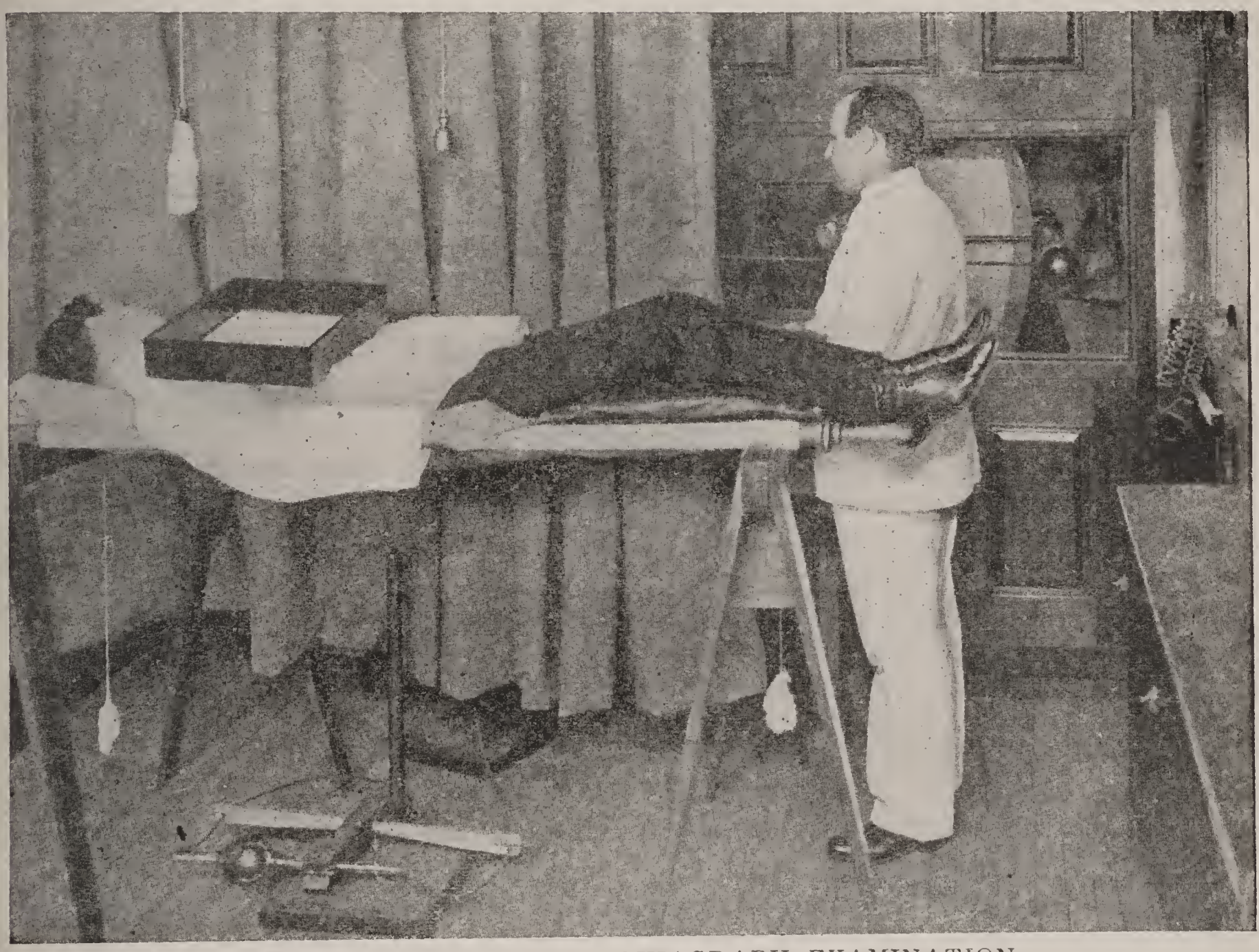
For many years the vapor and Turkish baths have been considered of great benefit in relieving many ailments. Natives of Australia, and also of India, have a successful habit of at once taking violent exercise on beginning to feel ill, upon the grounds that the sweat produced thereby will cleanse the body of impurities. It is stated that years ago the Arabs knew of sweating as a cure for hydrophobia and other poisoning. The patient was swathed in woolen covering till all but smothered, placed in a small tent of camel's hair and almost air-tight, and then left to sweat it out. This treatment has been found effective even for snake bites. The Buisson treatment is of the same nature.

A good many years ago, Dr. Buisson, a French physician, was called to attend a woman attacked by hydrophobia. In bleeding her, as was the custom at the time, he cut his finger, and incautiously wiped it upon her handkerchief covered with her saliva. He cauterized the wound when he reached home, but to no effect, for he was taken down with the rabies almost a month after. His pain was so acute and his death so certain that he sought for the easiest method to die. For some time he had considered a vapor bath preventative but not a cure for hydrophobia. He now thought of this as possibly the least painful way to die, hoping that the warm vapor might produce a languorous feeling, letting him peacefully sink off into a death slumber. Accordingly he went to a vapor bath, desired a very high temperature, and at 127 degrees Fahrenheit was cured.

He at once commenced to experiment with his discovery, with the result that he soon claimed cures for the disease even in its last stages, and prevention positively in its early forms, without the danger of the use of possibly fatal methods. Since the time of his work his followers have gone on establishing branches all over the world. Marvelous cures have been reported from every quarter and sometimes with the aid of only the crudest appli-

ances. Recently a keeper of a Turkish bath establishment in Milwaukee, Wis., learned that his dog had the rabies. In trying to coax him into a bath room, he was bitten in the hand. It has been always considered impossible to cure a dog of the rabies, but after several hours' treatment to a vapor bath, during which time the dog snapped and bit at everything in the room, he finally went to sleep and awoke cured. The keeper took a similar treatment at a high temperature and never felt any evil effects from the bite. For country use it is maintained that simply a pan of water over a lamp, with the patient sitting in the vapor and covered by heavy blankets, has effected cures.

Two theories are advanced for the curative properties of the vapor bath: one is that it opens the pores and allows the impurities to escape; the other, that the intense heat to which the body is subjected kills the poisonous germs. When medical aid cannot be summoned, life may often be saved simply by reverting to an old-time sweat.



METHOD OF MAKING A SKIAGRAPH EXAMINATION.

In the box on the patient's chest is a sensitive photographic plate. Below, on the floor, is the tube which develops the X-ray. The light passes through the patient's body and prints a shadow on the plate

Appendicitis.

Operations for appendicitis, or inflammation of the vermiform appendix, have in

recent days been brought down nearly to perfection. In the old days of crude surgery, when one had peritonitis (intense inflammation of the bowels) he generally died, for this was not considered a case for surgery. But to-day, on the least sign of inflammation of the appendix, care is taken that medical aid is at once called to reduce if possible the swelling, and as a last means surgery is resorted to. The appendix is a long, narrow, worm-like tube attached to the cæcum (one of the bowels) on the right side of the abdomen near the hip. It is from three to six inches long, has a diameter about equal to that of a goose quill, and opens into the bowel by a rather imperfect valve. Inflammation of this tiny organ,—which, by the way, has no known use,—is rare in infants, and occurs in both males and females, though more commonly in the latter. It occasionally happens without the action of mechanical injury, and then it is supposed to result from the action of very small organisms, though it is due mostly from fecal concretions and foreign bodies such as grape and other fruit seeds, buttons, bits of bitten finger nails, and worms. It has also been caused by extension of catarrh of the intestines. These foreign bodies produce inflammation, which is generally attended by ulceration. If the poisonous matter is not gotten rid of, it will soon form a coating around the appendix and neighboring bowels; then the appendix is gradually eaten away, and when the abscess breaks it lets all the poisons into the abdominal cavity, which at once causes peritonitis, and frequently soon results in death. The most characteristic symptoms are pains, swelling, tenderness and rigidity of the abdominal wall on the lower right side. Experience has taught that almost without exception sudden pain in this region, with fever and tenderness, with or without a swelling (tumor), means appendicitis.

The Surgical Operation

starts with an incision from four to six inches long over the inflamed part. The deeper tissues or muscles are drawn back and held away from the opening by clamps. Occasionally an exploration needle is used to probe for the abscess before the operation, but this is generally condemned; however, after or during the operation, this needle may be used to a good advantage. As soon as the abcess is reached, the contents are washed out with a weak antiseptic solution, and search made for fecal concretions or foreign bodies. Then the bowel is drawn out, and the appendix removed, if it has not already been so perforated as to be nearly gone. After cleansing and sewing up the bowel it is replaced in the abdomen, and the incision in the wall of the latter is closed by sewing. Sometimes, when an abscess occurs, the incision must be kept open to allow impurities to pass out; in this case the stitches are made but not drawn close at first.

Skin and Bone Grafting.

Improvement along the line of skin-grafting and bone-making is going on rapidly. It is no uncommon occurrence to-day to graft over burned or diseased spots large pieces of flesh and skin, taken from the body of a healthy person. In bone-growing, animal bone has practically supplanted the insertion of foreign substances, such as plates of silver and the like. Decalcified bone chips (that is, bone with the lime taken out) are prepared from the fresh tibia or femur of an ox by being kept in a weak solution of hydrochloric acid for about a week. The periosteum, or outer skin of the bone, and the medullary tissue (marrow) are

removed and the flimsy bone is cut into long strips about one-eighth of an inch wide. These, when they are to be used, may be cut into smaller pieces, and laid in the cavity of the patient left by the old bone being taken out. The skin of the wound is replaced, and gradually the grafted bone grows into the bone of the patient and performs its new functions as well as that with which he was born. For cranial defects, larger bones must be sought out and used in the same way.

Voyaging at Bottom of the Sea

Wonderful Boats that Navigate below the Surface of the Deep.

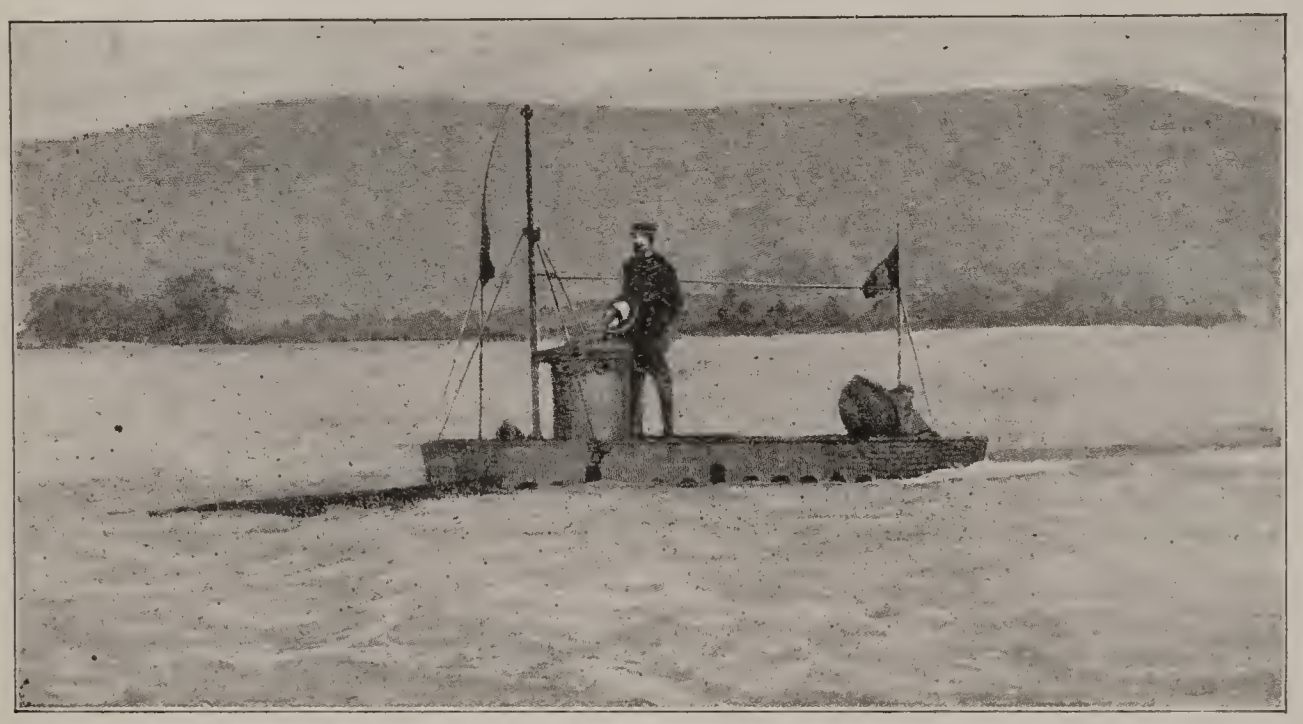
SINCE the day when Jules Verne wrote his famous "Twenty Thousand Leagues under the Sea," there has constantly been some inventor experimenting to solve the problem of traveling by a boat submerged under the surface of the water. Verne's boat, the "Nautilus," was a marvel of imagination, but others as wonderful in their reality have appeared, which, though not perfect in all things desired, yet do operate at the bottom of the sea, float under the surface for several hours, and come up again safely. Such boats are being constantly studied by the war departments of the great powers perhaps more than by any one else, for reason of the uses to which they may be put during war. Such a submarine traveler, supplied with a number of torpedoes and with an air supply to last the crew a few hours, could send to everlasting rest a whole navy, equipped though it might be with the most modern methods for protection and attack.

France, as much as any other nation, has been interested in this subject, and the result of her studies has been several boats brought forth by the skill and inventive genius of Gustave Zédé. This clever man, in 1886, built at Toulon an experimental vessel,

The "Gymnote,"

so as to test the principles he held with a view to embodying them in a larger and more complete war vessel. This boat was not much more than a large Whitehead torpedo, made of sheet steel in the shape of a cigar, being 56.7 feet long by 5.9 feet in diameter, and with displacement of thirty tons. To this shell were attached horizontal and upright rudders, so that she might be steered straight ahead by using the usual rudder, or might be made to dive or rise by use of the horizontal rudder. Electric motors with storage batteries supplied the power for the screw propeller, and a speed of seven knots an hour submerged and of nine knots

on the surface were secured, while the batteries would run constantly for from four to five hours. Buoyancy was secured by a watertight compartment fore and aft, and sufficient compressed air was stored to supply the crew of five men when submerged. Besides these contrivances there was a heavy ballast attached to the bottom of the boat on the keel, that could be detached at a moment's notice in case of accident, thus allowing the vessel to rise. A long tube with reflecting lens and mirrors rose from the



THE "GYMNOTE" TRAVELING AT THE SURFACE.
Showing conning-tower and prismscope just in front of the captain.

boat like a mast. This could be bent at an elbow at right angle and made to turn about, so that the image of any object at any point of the horizon could be reflected to the cabin of the boat when it was submerged. Without this "prismscope" it would be almost impossible to keep track of the enemy when on a cruise under the surface.

The experiments with the "Gymnote" were so wonderfully successful that the French government at once set Zédé to work making a large one for practical use. The result was the vessel about which all the countries are talking, and which, in honor of the inventor, has been named the

"Gustave Zédé."

The length of this boat is 147 feet, diameter 10.75 feet, and displacement 260 tons. The hull follows the general lines of the former model, being cigar shaped with very sharp ends. The speed has been increased to 8½ knots an hour below and 14 knots on the surface. Ten men constitute the crew, and enough stored air is carried to last them while below In the nose of the boat is an opening for discharging an ordinary torpedo. She has already operated in deep and shallow water with remarkable success, and trips averaging between seventy and eighty miles are her average runs, thus giving her power to make a fighting dash at any enemy within a radius of thirty-five miles, and return in safety.

Various boats having the same general principles have been made and operated with much the same success, among others the Nordenfeldt, the Peral, Goubet, and the Holland, the latter a remarkable vessel built by an American ar d used to some extent by the United States government.

Of a different sort altogether, however, is Simon Lake's invention,

The "Argonaut."

Knowing the difficulties that beset the path of the inventor who tries to keep his boat floating under the surface in equilibrium with the water, he set about to contrive one that would travel on wheels at the sea bottom. In all types of floating boats, there is great danger of misplacing the ballast and thus tipping the boat over



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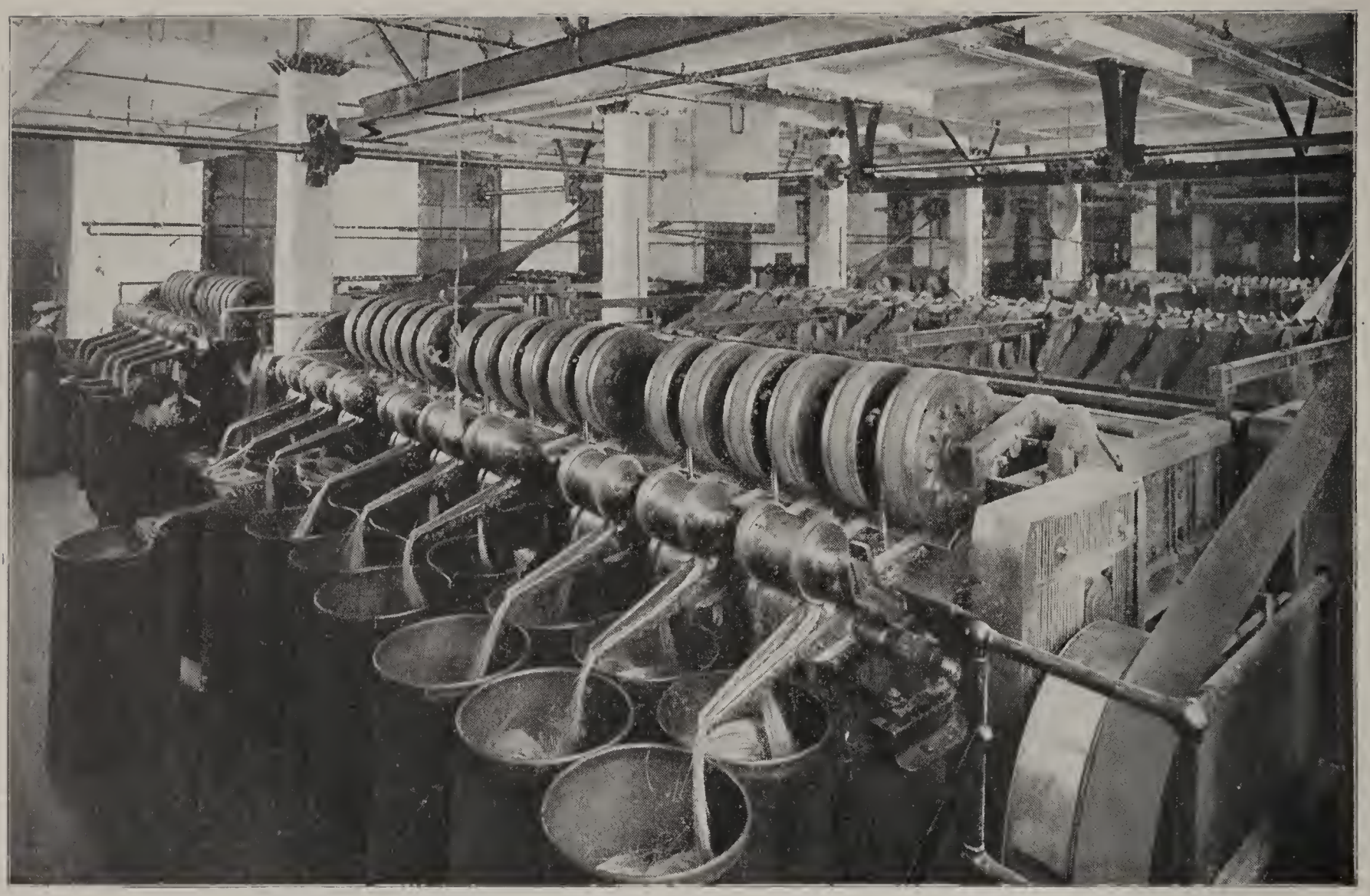


A KNITTING FACTORY, SHOWING OPERATORS SEATED AT THEIR MACHINES KNITTING HOSIERY. THIS INDUSTRY HAS SPRUNG INTO EXISTANCE WITHIN THE LAST DECADE. GRANDMOTHER'S KNITTING NEEDLE IS A WEAK COMPETITOR OF SUCH AN ESTABLISHMENT



GENERAL VIEW OF CHICAGO NEAR THE MOUTH OF THE CHICAGO RIVER

TO THE RIGHT IS THE LAKE, AND NEAR THE CENTRE IS THE RIVER, SHOWING THE GRAIN ELEVATORS AND RAILROAD FREIGHT TERMINALS OR YARDS
MORE FREIGHT IS DISPATCHED FROM THIS POINT THAN IN ANY OTHER SIMILAR AREA IN THE WORLD



MANUFACTURING TWINE OUT OF SISAL, OR HEMP

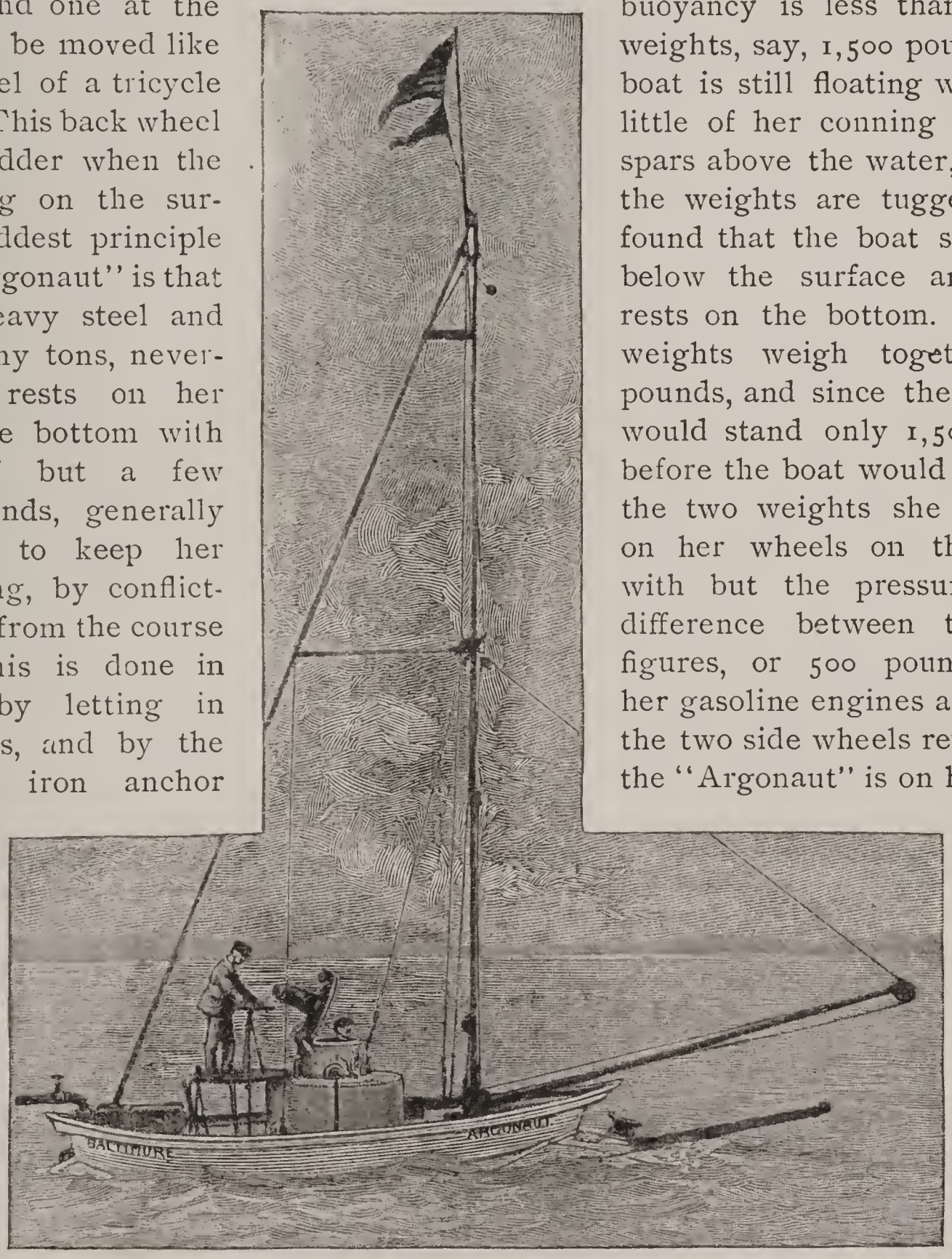


A STOREROOM OF SISAL, SISAL GRASS IS OTHERWISE KNOWN AS HEMP, AND IS USED IN THE MANUFACTURING OF TWINES AND ROPES

on her side. This was what Lake figured against, and accordingly he brought out a boat that would float on the surface propelled by a screw, yet when closed and loaded with its water ballast, would sink to the bottom and advance along the unknown highways by means of large wheels, after the style of a locomotive. There are three of these wheels, one at either side, and one at the back that can be moved like the front wheel of a tricycle for steering. This back wheel is also the rudder when the boat is sailing on the surface. The oddest principle about the "Argonaut" is that though of heavy steel and weighing many tons, nevertheless, she rests on her wheels at the bottom with a weight of but a few hundred pounds, generally just enough to keep her from deviating, by conflicting currents, from the course laid out. This is done in two ways: by letting in water ballasts, and by the use of two iron anchor weights weighing 1,000 pounds each. When it is necessary to go

Below the Surface,

the hatches are closed tight, the two weights, which are attached by cables to a windlass, are released and at once fall to the bottom. Then the water is let into the ballast compartments till the buoyancy is less than the two weights, say, 1,500 pounds. The boat is still floating with just a little of her conning tower and spars above the water, but when the weights are tugged at, it is found that the boat slowly falls below the surface and at last rests on the bottom. The two weights weigh together 2,000 pounds, and since the buoyancy would stand only 1,500 pounds before the boat would sink, with the two weights she now rests on her wheels on the bottom with but the pressure of the difference between these two figures, or 500 pounds. Now her gasoline engines are started, the two side wheels revolve, and the "Argonaut" is on her voyage

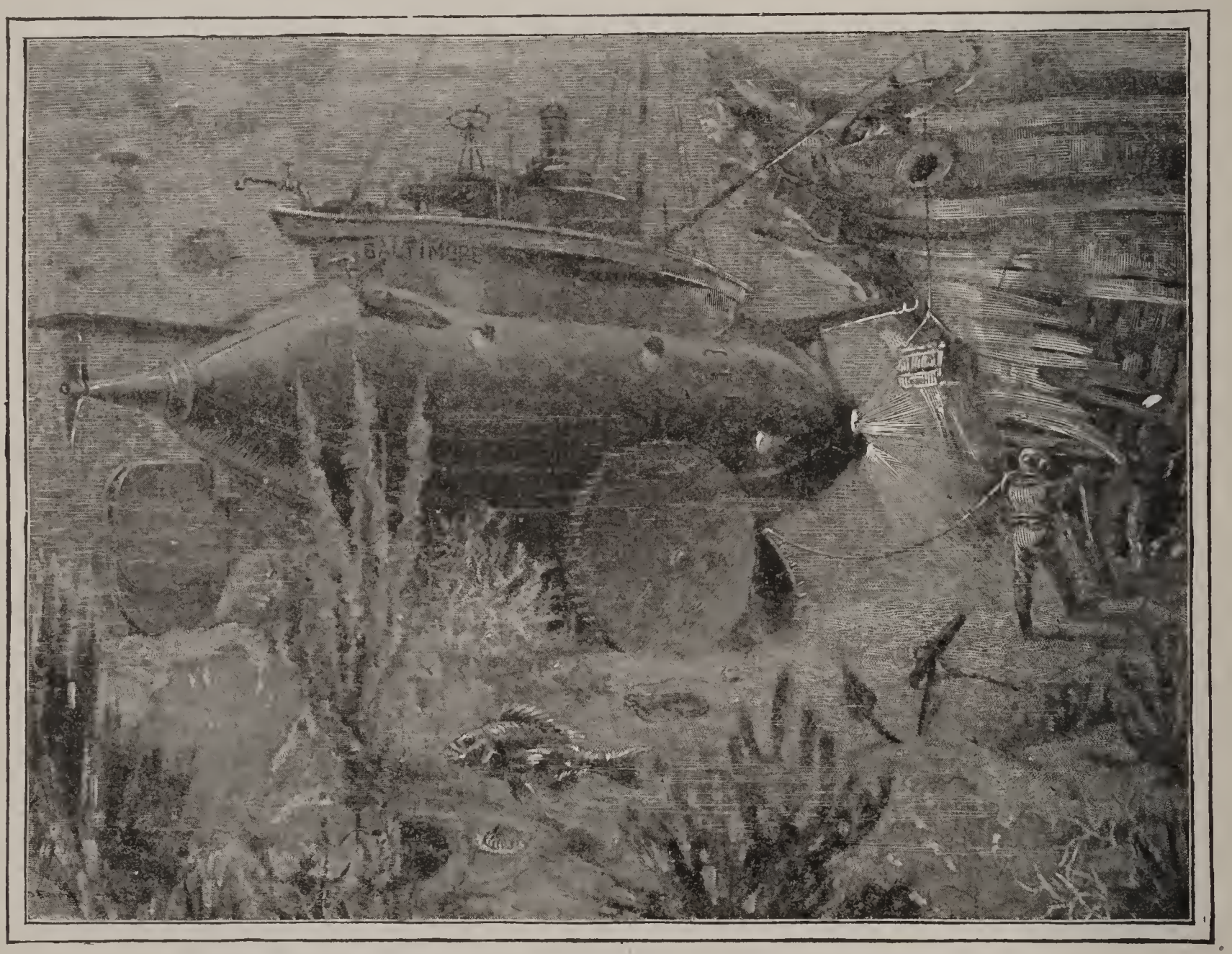


THE "ARGONAUT" FLOATING AT THE SURFACE.

Near the center is seen the open conning-tower with a man's head appearing. From this tower the boat is operated when below the surface. The man behind is steering by means of the submerged third wheel of the boat. Down one of the tall, hollow, steel masts, when nearly submerged, comes the supply c fresh air, and out at the other goes the exhaust steam.

among the queer sea monsters, aged wrecks and untold treasures.

The vessel is thirty-six feet long, cigar-shaped, with blunt nose and pointed stern, and is fitted with a thirty-horse power gasoline engine which operates the screw propeller, driving wheels, the electric dynamo, the air compressor, and derricks for hoisting the weights. Like many other submarine boats, she is supplied with air when all but below the surface, by a steel tube reaching up in the air in the shape of a mast. Down this comes a fresh supply of air, and out at another similar one goes the exhaust steam from the engine. In her nose is a searchlight that shoots out rays far ahead into the water; on her bottom is a heavy false keel that may be released in case of accident allowing her to rise because of added buoyancy. The vessel is guided by a compass, and it is found that this is entirely practicable below as well as above water, only it must be kept high above the machinery, which would otherwise affect her needle. Compressed air is resorted to for breathing supply when the boat is so far below the surface that the engine has to be stopped and the masts are entirely submerged. Then the elec-



A WEIRD SUBMARINE VOYAGE OF THE "ARGONAUT."

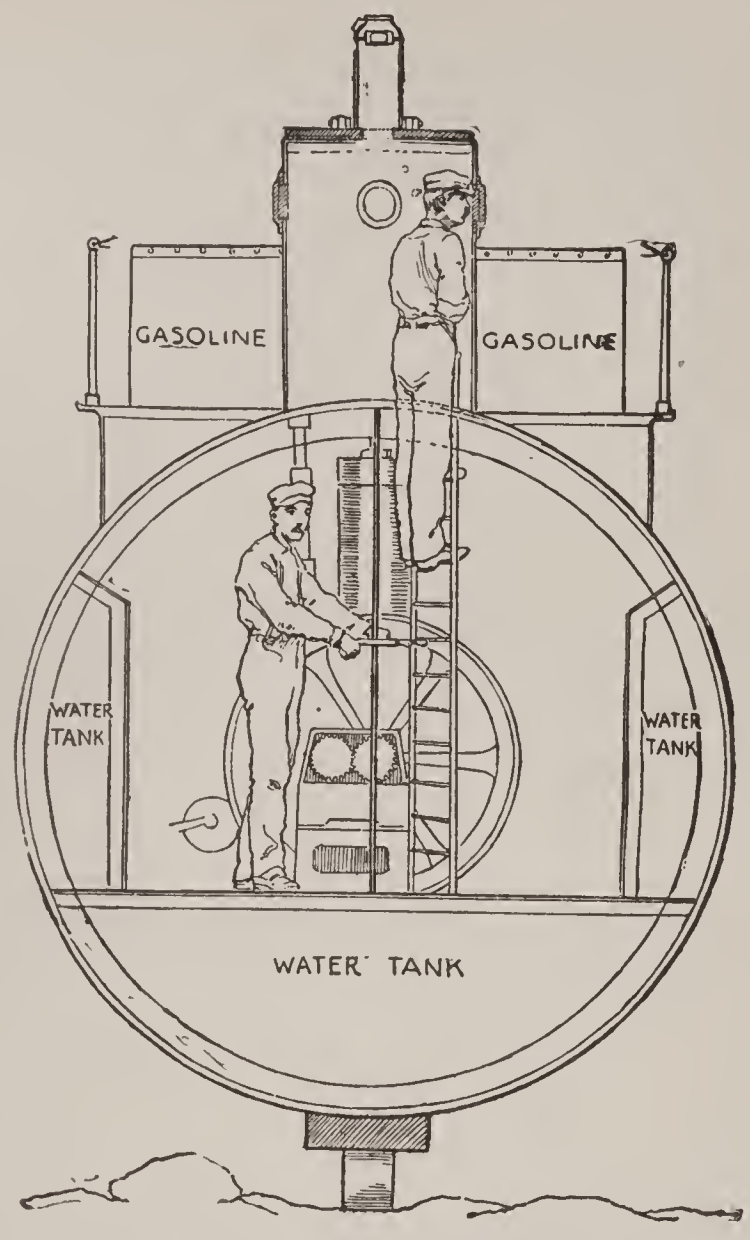
At the prow of the boat is seen a diver at work on a sunken vessel. He has just emerged from the open trap-door, and, with the aid of the powerful electric search-light in the nose of the vessel, is about to explore the unknown interior of a long-lost treasure-ship. About him, in all their glory, thrive the marvelous exotic plants of the deep sea, while, attracted and dazed by the fierce lights of the vessel, swarm the man-hunting shark and other queer ocean fauna.

tricity, stored up by the dynamo while the engine was working, is used to operate the machinery. Trips of 1,000 miles have been made in the "Argonaut" without landing, a great part of which was spent below. Air supply sufficient for five men for twenty-four hours is easily stored, and with occasionally running up near enough to the surface to let the steel tubes send down more air, these trips can last as long as gasoline and food hold out.

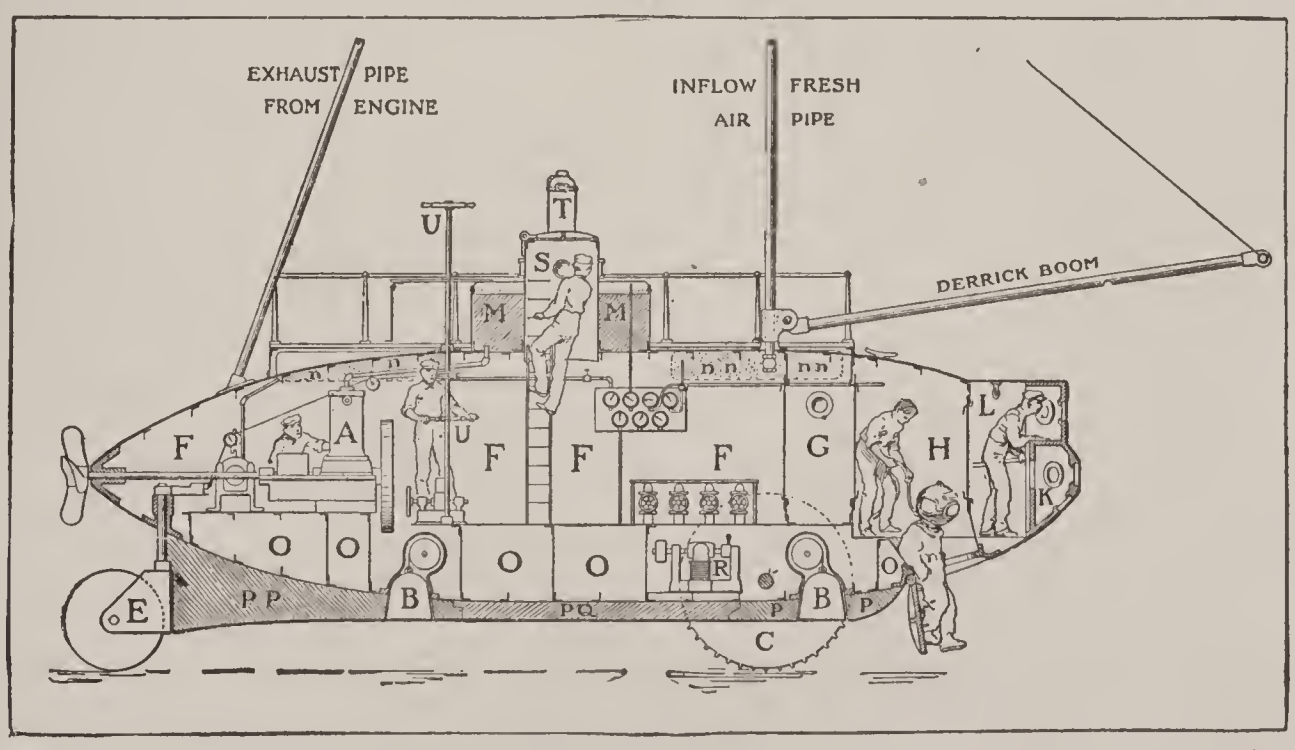
But simply to go below the surface and not be able to leave the boat would be of little avail. The "Argonaut" is therefore fitted with

Diving Apparatus,

so that men may leave the boat at any time, explore a wreck fasten a torpedo to an enemy's war ship, pick up a cable and cut it, or go a-fishing after sharks. This is all done by means of a hole in the bottom of the boat near the forward end. When a diver wishes to leave the boat, he puts on a diving suit and goes into the diving compartment, which has a great heavy door with rubber packing. This



Sectional view of "Argonaut" submerged, showing man in conning-tower making observations; also man steering with third wheel, which rests on the ocean bottom. Water tanks are filled when descending, and pumped dry when ready to come up.



A, gasoline engine, 30-horse power, which supplies all the power in moving and operating boat. BB, two anchor weights used in sinking boat. C, one of the two driving wheels. E, rudder and guiding wheel. FFFF, living room, in which are placed the engine and all other machinery and apparatus for operating boat. G, air lock; this affords a passage to and from diver's room without reducing air pressure. H, diver's room, whence is had free passage into the sea. K, bow compartment where searchlight is placed. L, forward lookout compartment. MM, gasoline tanks. NN, compressed-air reservoirs. OOOO, water-ballast compartments. PP, permanent keel. PQ, drop keel. R, dynamo. S, conning-tower. T, binnacle; the compass in this binnacle is in direct view of the outside steering gear, but from the conning-tower is read by reflection. U, outside steering gear. In general form the "Argonaut" is cylindrical, or cigar-shaped, with a very bluff bow, a pointed stern, and is 36 feet long.

door he closes, and cuts off the diving compartment from the living rooms and machinery. Then he turns on the compressed air till the pressure in the room is greater than that of the water that wants to come in. He then lets drop the heavy iron door to the hole in the bottom of the boat, and steps out, and not so much as a drop of water enters the vessel. Or suppose in time of war the telegraph cables of the enemy are to be cut. Instead of putting on a diving suit, the man to do the work simply goes into the diving room, turns on the air pressure, lets the trap door drop, and by means of a short wooden stick with a hook in the end reaches down and picks up the cable and cuts it.

The possibilities of such a boat are very great, both in time of peace and war. In salvaging wrecked ships and treasures a submarine boat would do marvels, as well as in pearl, sponge and coral fishing. The work of laying foundations for lighthouses, piers and breakwaters would be wonderfully facilitated, as well as in landing armies during a blockade, and blowing up war ships.

UNIVERSAL DISARMAMENT.

THE PEACE CONFERENCE OF THE CZAR.

AUGUST 24, 1898, by order of Nicholas, the emperor of Russia, Count Muravieff, the Russian minister of foreign affairs, handed to all the foreign diplomats at St. Petersburg a note calling for a meeting the next year of all the countries interested to discuss the question of decreasing the armed forces of the world, with a view to an universal peace sometime in the near future. It held that recent expansion of the governments and armed forces of the world were to be deplored, both from a humanitarian and an economic point of view, and that the czar held it his duty to help ward off the calamities that must soon threaten the whole world. After a session of some six weeks at The Hague, capital of the Netherlands, on July 24, 1899, the final acts of the conference thus called together were embodied in a final act. This act held that there should be a permanent

Court of Arbitration

for the pacific settlement of all international disputes; that asphyxiating and deleterious gases should not be used in projectiles from balloons in war; that dum-dum bullets, or those made of soft material that will easily expand in the human body, should be prohibited in war; and that it was desirable that all countries limit their great military forces which so burden their own people and threaten the world. It also held that it was the right and duty of neutrals to offer their services toward the peaceable settlement of difficulties between other nations; and that all private property on land should be inviolable in war, and that in naval war towns and villages should not be bombarded.

OUR NEW POSSESSIONS.

THE UNITED STATES AT THE EQUATOR AND EXTENDING NEARLY HALF-WAY AROUND THE GLOBE.

New territory to the extent of 170,000 square miles, with populations numbering over ten millions, now under the protecting folds of the American flag.

THE Philippine Islands lie just east of Cochin China, being separated from it by the China Sea, and are between the fourth and twentieth degrees north latitude, and 116 and 126 east longitude. There are thought to be about 2,000 islands in the group, though this is not certain. A recent writer says: "The number of islands which form the Philippine archipelago will astonish many readers. It is said to approach 2,000. There are among them two which are larger than Ireland, namely, Luzon, with 42,000, and Mindanao, with 38,000 square miles. There are other islands with 5,500, 5,000, 4,500, 4,000, 3,500, and 3,000 square miles." Of the whole number some 600 are inhabited. The estimates of the population vary from 6,000,000 to 9,000,000, the fair estimate being about 7,500,000. Nearly half this number inhabit the principal island of Luzon, on which is the capital, Manila, and where nearly all the fighting of the Filipino war has taken place.

As many races almost as islands people this odd archipelago. Most important are the

Tagals of Luzon,

who number about 2,000,000 souls, and who are leading in the rebellion against the United States government, headed by their chief, Aguinaldo. They are a short, copper-colored people of the Malay race, and of exceptional cleverness. Next to them in point of intelligence are the Vicols, or Bicols, who occupy the Camarines peninsula and the islands of Catanduanes, Burias, Ticao, and half of Masbate. They resemble the Tagals, and number about 400,000. The third division of the people are the Visayas, or Bisayas, who occupy the islands between Luzon and Mindanao, and are estimated at 2,500,000. Besides these are the Moros of Sulu, the Negritos and some others of the Malay race. Little is needed or desired by these natives. The soil of the islands is rich, and the rivers teem with fish; so that with a fighting cock, which every Filipino dearly loves, and scanty attire, he leads a happy-go-lucky life.

The islands were discovered by Magellan, who landed on the island of Cebu in March, 1521, and soon after lost his life in a skirmish with the natives. In 1565 a fleet from Mexico took possession of the islands, and in 1570 a settlement was established on the Manila River, which place became the capital of the Spanish possessions in the Philippines, and continued such till the late war. Before the arrival of the Spaniards the place had

been under the dominion of the Chinese. The Dutch made an unsuccessful attempt to capture Manila in 1606, and the British succeeded in a capture in 1762. The Philippines would probably have been British to-day, had not Spain promised to ransom them for $5,000,000, which, however, remains unpaid to this day. Rebellions have been frequent in the islands ever since Spanish rule, those of 1822, 1841, 1842, 1872, 1896 and 1897 being the most important. The revolts have all had a common cause, that of freedom from Spanish tyranny. When the United States went to war with Spain, the Filipinos, under several chiefs and headed by Aguinaldo, assisted the Americans in hopes of gaining their freedom from Spain. But after the treaty of Paris, which ceded these islands to the United States pending the establishment of a government for and of the native inhabitants, the Filipinos rose in

Revolt

against seeming annexation to the United States, and since that time have conducted a sort of guerrilla warfare against the American troops. An actually established government is claimed to exist by the natives, but the capital seems to travel with the fleeing president. At present the government of these islands is that of martial law, aided to a degree with civil courts maintained by the natives, who likewise aid in the government of the municipalities.

There are

Two Seasons,

a wet and a dry; the first from June to November, the dry season from November to June. In the wet season the country is inundated, the roads are impassable, and the bridges disappear. The annual rainfall is from seventy-five to ninety-one inches. The hottest months are April and May; the droughts are then long, and the ants and mosquitoes troublesome. The coolest months are December to February. The average temperature is 80 degrees. Cyclones, typhoons and hurricanes visit the coast, and earthquakes are frequent. Many craters of extinct volcanoes are found, and some active ones are in operation. The highest mountain of the group is that of Apo on Mindanao, which is 9,000 feet high, while Halcon, in Mindoro, reaches nearly 8,900 feet, and Majon, in Luzon, exceeds 8,200 feet.

The soil of the islands is very fertile, and the products are sugar, hemp, tobacco, rice, coffee, gums, cotton, indigo, cochineal, and cocoanuts. In the forests grow rattan, bamboo, ebony, logwood and numerous other hard woods and gum-yielding trees. The celebrated Manila hemp is not made from hemp, but is the fiber of a species of banana. The Philippines are fabulously rich in gold, and copper and coal have been discovered in large veins. We had exported to these islands before the war merchandise amounting to about $100,000 yearly, and imported about $5,000,000, but since the islands are now American dependencies, this commerce has been greatly increased.

Sultan of Sulu and His Island Domain.

Mohammed Tamajamalu Kiran, Sultan of Sulu, the monarch who is now, or who will be, something of an issue in American politics, because of his recent treaty acknowledging American supremacy, is the ruler of 140 islands in the Philippines, of 120,000 subjects and a dozen wives. The sultan, his people, his wives and the 75,000 slaves in his islands are now subjects of the United States. He is known by many titles other than sultan, for example, "The Stainless One," "The Spotless One" and "The Mountain of

Light." His dress is simple, consisting of one garment, after the fashion of a modern night shirt. He is a short, fat man, with a round, boyish face and big, saucer-like eyes. Kiran lives in a small house protected by a stone wall ten feet high and quite thick. The first floor contains only one room, a large, bare apartment. The sleeping-rooms of the "palace" are on the second story. The Moros—that is the name of the sultan's subjects—have the reputation of being an innocent, harmless people, but when General Bates visited the islands on the Charleston he found that most of the inhabitants went about armed. The mother of the sultan is regarded as the most beautiful woman among her people.

THE MARIANA OR LADRONE ISLANDS.

The Mariana archipelago is a chain of islands in the Pacific stretching north and south a winding distance of about 600 miles, and embraces some seventeen islands, having an area of about 500 square miles. The islands were discovered in 1521 by Magellan, and were named in honor of Mariana of Austria, wife of Philip IV. king of Spain, though in the later days of piracy they were dubbed the "Ladrones" or "robbers," because they were supposed to be the stronghold of those pests of Asiatic waters. They are almost directly east of the Philippines, at a distance of about 1,200 miles. The principal island of the group is Guam, or Guahn, which covers nearly one-half the area of the archipelago. Formerly, when Spain first took control of the islands, the natives numbered about 120,000, but the oppressions were so great that one-half that number were killed off, and the greater part of the rest fled to the Caroline Islands. Colonization was tried from the Philippines, but these emigrants died of epidemics. In 1760 the population had been reduced to 1,600, and in 1875 but 600 survived.

The climate is very moist, several rain squalls occurring every day, which, however, the natives do not seem to mind, for it keeps the air cool. The natives grow sugar cane, rice, corn and melons. The soil is well adapted to coffee growing, but this is done only to a limited extent, while all sorts of tropical fruits abound.

Commercially the group is of little importance, for the natives need little, and no trade is done. However, the possession of Guam by the United States, which came about by the treaty of Paris, is of some political value for a coaling station, and as a near neighbor to the Philippines in case of war.

THE SAMOAN OR NAVIGATOR'S ISLANDS.

The Samoan group consists of thirteen islands, of which nine are inhabited, lying in the south Pacific Ocean, between 13 and 14 degrees of south latitude, and 169 and 173 west longitude. They are about midway on a line drawn southwest from the Sandwich Islands to New Zealand. A population of about 40,000 people, including, besides natives, Americans, Germans and English, covers the area of some 1,125 square miles. Upolu, Savaii, Tutuila and Manua are the islands of most importance. Apia, on Upolu, is the chief town, and a good seaport, while Pango-Pango, or Pago-Pago, on Tutuila, is possibly the best harbor in any of the Pacific islands, and being in direct route from San Francisco, is developing into an important port.

The climate of the islands is equable, averaging about 82 degrees, while the rain is rather evenly distributed through-

out the whole year. Tropical plants of all kinds abound, and while the commerce of the group is small, exports of cotton and the dried meat of the cocoanut are made to Hamburg and San Francisco. The natives are well developed and intelligent.

The government by chiefs was unsatisfactory, so that in 1873 they desired the protection of the United States. In 1875 a native was elected king again, but with an American for prime minister. In 1878 a treaty between the islands and the United States was effected which gave us great powers, and later on similar treaties were made with Great Britain and Germany which led to a tripartite protectorate over the islands by these two governments in conjunction with that of the United States. A chief justice appointed by the three powers to some extent controlled the courts and advised the king, while the consuls of the three countries took a prominent part in the government. From time to time jealousies arose between these three countries, and annexation to one or another of them was proposed. In 1898 and 1899 a serious difficulty was incurred because of the death of the reigning king, and American forces were landed at Apia with threats of bombardment. Trouble between the German and American officials was at last patched up, and a division of the islands among the three countries will be the result.

Tutuila,

the island that will come to the United States as the issue of the Anglo-German treaty, gives us the finest harbor of the south seas, Pago-Pago. The island has an area of 55 square miles, being nearly 17 miles long and from 3 to 5 miles wide. It is well wooded and fertile, and has some rivers of fair size. The harbor has been held by the United States since 1872, and from a strategic point is very desirable, especially as a naval base of operations in the Pacific. The harbor is a natural one, and well sheltered, and may be easily fortified. It is 2,000 miles from Australia, twice that distance from the Philippines, and 5,000 nautical miles from San Francisco. With the Philippines in the possession of the United States, this new dependency is invaluable.

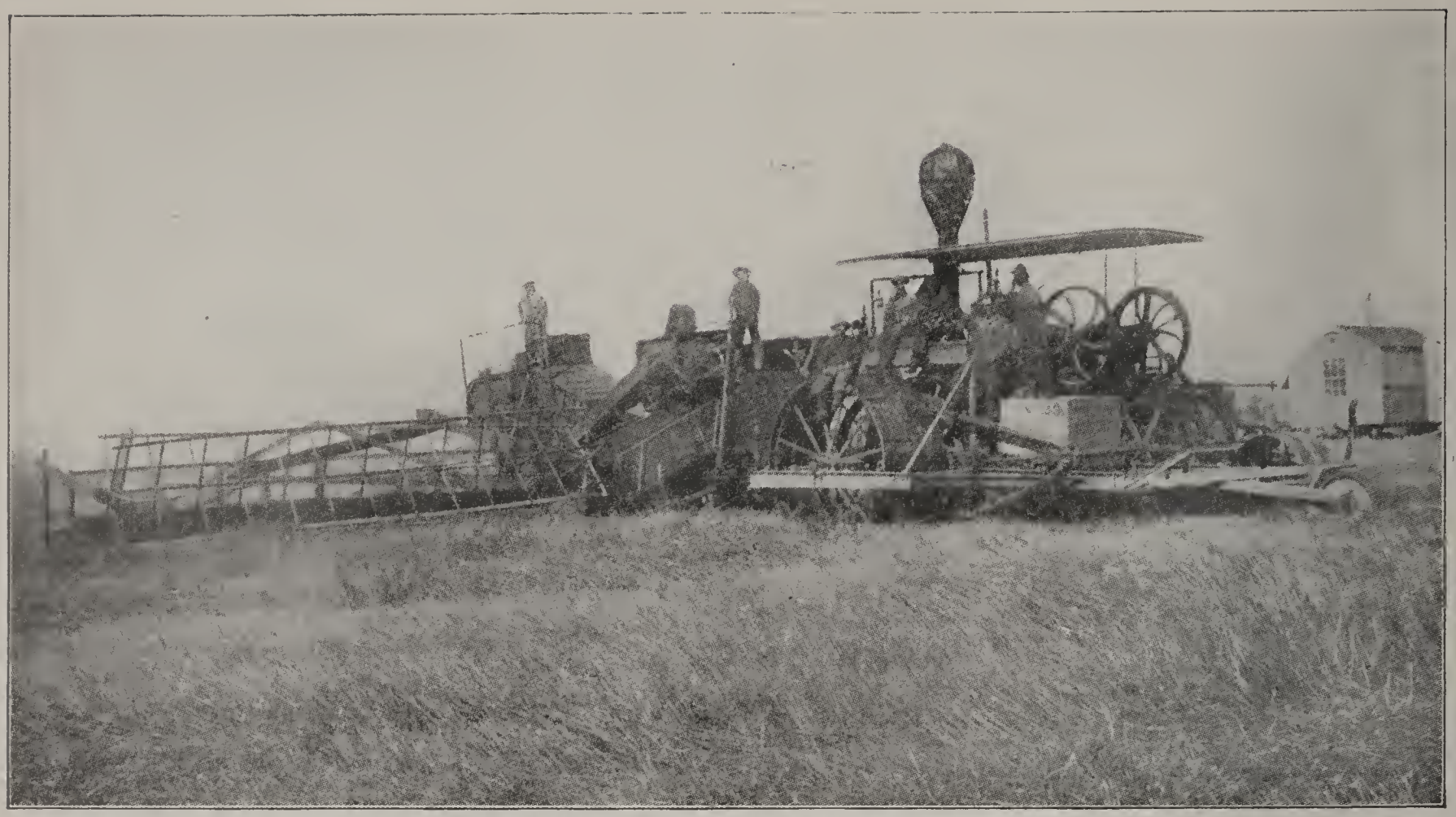
PORTO RICO.

The island of Porto Rico, or, according to the Spanish spelling, Puerto Rico, meaning "rich port," is fourth in size of the Greater Antilles, being exceeded by Cuba, Santo Domingo and Jamaica. It lies between the seventeenth and nineteenth parallels of north latitude, and the sixty-sixth and sixty-seventh degrees of longitude, and contains about 3,668 square miles, being about 35 miles broad and 95 miles long. The island was discovered by Columbus on his second voyage, November 16, 1493. Ponce de Leon, the celebrated explorer, was one of the first Spanish governors, and the wrongs heaped upon the natives by his arbitrary rule led to revolts. Several attacks upon the island by English and Dutch forces met with no success. The last one prior to that of our late war was by the celebrated British commander, Sir Ralph Abercromby, who laid siege to San Juan in 1797 for about two weeks. Owing to insufficient forces, he had to withdraw, and from that time until the bombardment of May 12, 1898, by Admiral Sampson, that city had had a century's respite from the enemies of Spain.

Several rebellions by the people occurred with the hope of throwing off the galling Spanish yoke and establishing a republic. One of these was in 1820, another in 1867, the latter being broken up by



SIXTIETH ANNUAL CONVENTION BANQUET OF THE CHI PSI COLLEGE FRATERNITY, HELD AT THE AUDITORIUM HOTEL, CHICAGO. THE TABLES ARE ARRANGED TO FORM THE LETTER CHI OF THE GREEK ALPHABET



HARVESTING WITH A STEAM OUTFIT

THIS REAPER IS PUSHED BY A LARGE TRACTION STEAM ENGINE, CUTS A SWATH FIFTY FEET IN WIDTH, AND IS CAPABLE OF HARVESTING 100 ACRES FER DAY. IT THRESHES THE GRAIN AND BAGS IT, READY FOR HAULING TO THE M-FKET



A COMBINED HARVESTER AND THRASHER

SHOWING A MACHINE HARVESTING AND THRESHING WHEAT IN ONE OPERATION ON A 20,000 ACRE FARM IN THE NORTHWEST. THE HARVESTER CUTS THE HEADS OFF THE WHEAT AND DROPS THEM ON A MOVING CANVAS WHICH CONVEYS THEM TO THE RAPIDLY REVOLVING CYLINDER STUDDED WITH TEETH, WHICH LOOSENS THE KERNELS. THE SEPARATOR SEPARATES THE WHEAT FROM THE STRAW



GENERAL OFFICES OF SWIFT & CO., AT THE STOCKYARDS IN CHICAGO

THIS PICTURE SHOWS ONLY THE OFFICERS AND CLERKS AT THIS ONE OFFICE. IT IS THE LARGEST SINGLE OFFICE IN THE WORLD. THE BUSINESS IS SO SYSTEMATIZED THAT EACH EMPLOYEE'S WORK FITS IN LIKE THE COG OF A WHEEL IN A PIECE OF MACHINERY, AND ALL RUNS SMOOTHLY GRINDING OUT PROFITS TO THE COMPANY, AND DIRECTING THE PRODUCTION, TRANSPORTATION AND MARKETING OF MEAT FOODS FOR THE PUBLIC



MANY OF THE PICTURES OF GENERAL VIEWS IN THIS BOOK HAD TO BE MADE FROM A GREAT HEIGHTH. THIS ILLUSTRATION SHOWS THE BALLOON USED, WITH THE CAMERA AND MR. LAWRENCE, OUR PHOTOGRAPHER, READY FOR THE ASCENT

the eruption of a volcano, which so scared the people that they again gave in to Spain.

The island has a population of 815,000, of whom about 300,000 are negroes, the remainder being mostly Spanish, besides some Americans, English, Germans, and others of European nationalities. The surface of the island is broken by hills and low mountains, one range of which passes through it from east to west. The highest point of this range is El Yunque, which is about 3,700 feet above sea level. There are some 1,300 streams of remarkably pure water running into the sea, of which forty-seven are rivers of considerable size. Thus the island has abundant water supply for large herds of cattle.

The Climate

is exceptionally salubrious, mainly on account of there being ltttle stagnant water. Heavy rains occur in the north from May to September, sometimes amounting to seventy inches. In the south there is little rain at all, while over the whole island in the winter the air and sea breezes are delightful. Coffee, tobacco, and sugar cane are grown in profusion, while exceptionally fine cotton is cultivated. Besides these staples the island exports annually large quantities of cattle, hides, timber and molasses, while flax, ginger, rice, maize, citrons, lemons, oranges and other tropical fruits abound. Traces of some ores have been discovered, including gold, iron, copper and lead.

No portion of the West India Islands is lovelier or in better condition than Porto Rico. The climate draws many foreigners there for the winter ; the people are self-sustaining and hospitable, though somewhat ignorant and superstitious. Slavery was abolished in 1873, and the island is remarkably free from disorder. At first the government was temporary in nature, awaiting the decision of Congress as to the best methods of governing a race of people so diferent in all things from the average American.

When General Miles, with the

American Forces,

landed on the island in the summer of 1898, he was greeted everywhere as the benefactor of the down-trodden natives, and from town to town his victorious troops were met by the officials of the provinces, who gladly turned over the government to that of the United States. October 18, the flag of the United States was raised over San Juan, the Spanish evacuation having been completed, and January 1, 1899, the entire government, according to the Treaty of Paris, was placed in our hands.

The military administration of Porto Rico ceased on May 1, 1900, when Charles W. Allen, of Massachusetts, was installed as Governor of the island, and the civil government was instituted in conformity with the Act of Congress approved April 12, 1900. Departments and bureaus required by the new system were formed, and the administration of the affairs of the island has proved to be a complete success.

On May 21st, 1901, the United States Supreme Court decided that duties on imports from Porto Rico collected prior to the passage of the Porto Rican Tariff Act must be refunded, but that the Act itself is constitutional. On July 25th President McKinley proclaimed free trade between Porto Rico and the United States.

On September 16, 1901, William H. Hunt, who had held the position of Secretary of Porto Rico, was inaugurated Governor of the island in place of Charles H. Allen, who resigned the office.

The Modern Newspaper.

A GLIMPSE OF THE WORKINGS OF THE GREATEST AGENT OF MODERN CIVILIZATION AND EDUCATION—HOW A DAILY PAPER IS WRITTEN, PRINTED AND CIRCULATED.

Including Descriptions of Photo-Engraving, Stereotyping, and Printing by Monster Presses.

TIME was when the owner of a newspaper was editor, reporter, typesetter, "devil," presshand, and circulator, while besides the duties incumbent on these positions he had to see to the odds and ends belonging to no one in particular. But the day of the old Franklin hand press, and of setting up his articles in type before his case as the inspiration came to him, has passed, and now, with the division of labor, and the marvels of machinery, it is possible for the subscriber a hundred miles away to read in comfort at his breakfast table the metropolitan daily paper at the same time that other subscribers are reading it in the city where it is printed. To the persons who go to bed at nine o'clock and rise at five it is amazing that thousands of men and women are working while they sleep, and the sight of a large newspaper plant in full swing of operation would be still more wonderful.

Every well organized paper is divided into a number of departments, just like a government, with a head or ruler over each. In most papers there are three main departments: Business, Editorial, and Mechanical, and each of these has numerous subdivisions.

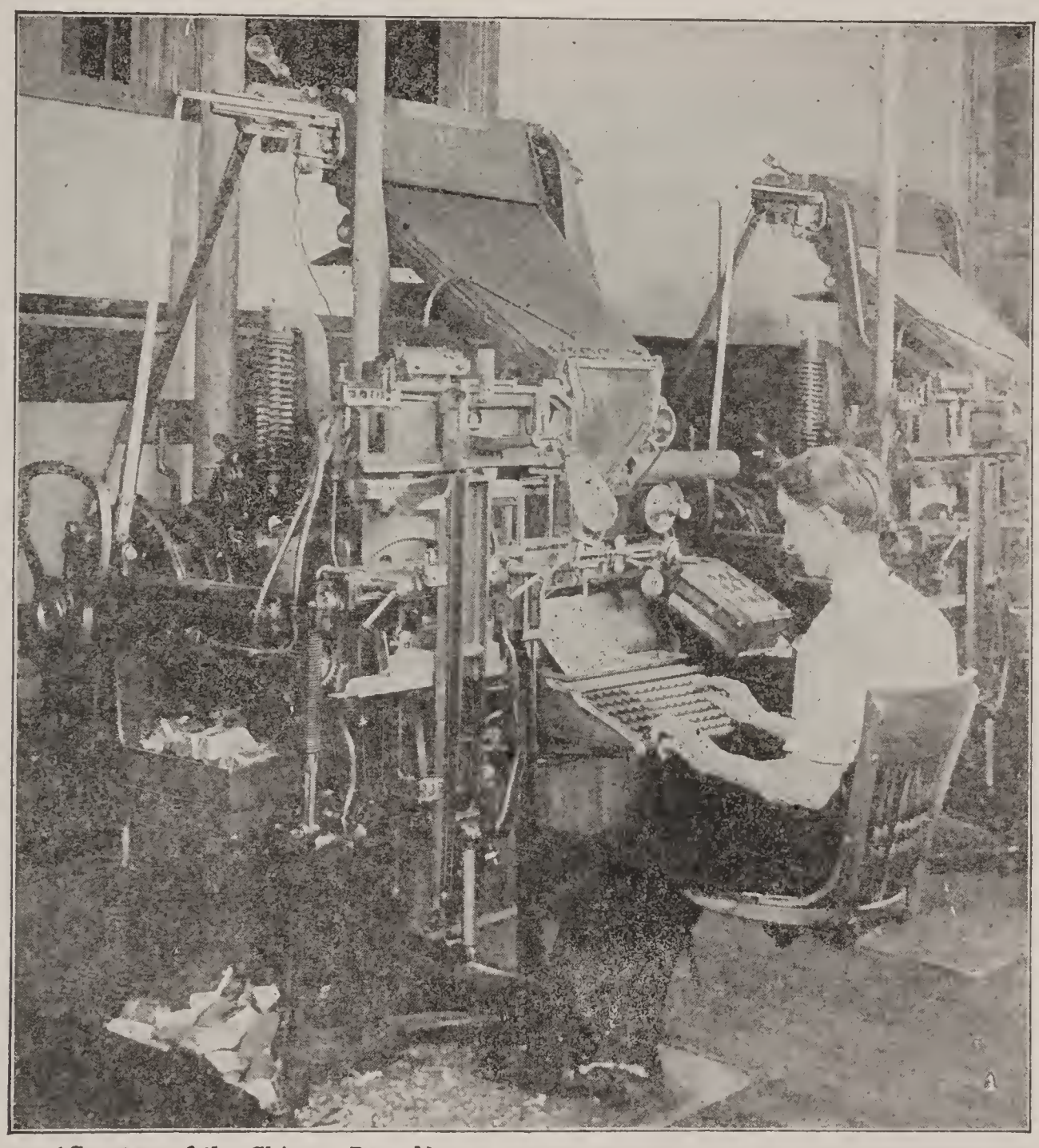
Upon the business departments devolve the duties of managing the capital invested, paying the salaries, etc., and the two greatest of all duties upon any paper that is expected to make money: the getting of advertisements, and the circulation of the paper to the subscribers. The editorial department has control of the reading matter and its preparation, while to the mechanical departments are left the duties of setting the stories, editorials and advertisements into type, the molding of the stereotype impressions of this type into great half-cylinders that are to be placed upon the monster presses, and the work of bringing forth from these presses the folded paper ready for its reader, at the astonishing rate of from thirty to fifty thousand copies per hour.

The Editorial Staff

of a paper is divided into several parts: the managing editor is head over every one in his department, and to some extent is consulted in other things than those pertaining to his own department; the city editor is directly under the managing editor, and controls a staff of reporters whose duties are to gather up the news about town and present it in readable and interesting form. Besides these two editors

and the staff of reporters, there are a number of men who write editorial comments on the great events of passing interest to the public; on them to a marked degree falls the lot of shaping a community's opinion on political or public questions. Then there are the special writers who write dramatic criticisms, sporting news, literary, art and musical notes and criticism, and last, but not least, on the up-to-date paper, the funny story man. Contrary to general opinion, the reporter does not go aimlessly about town looking for news. The modern city editor almost knows the news before it happens, and therefore has men suitable for the occasion on the spot waiting for it.

At 12:30 p. m. the reporters of a morning paper congregate in the "local" room and wait for the summons of their chief. For weeks ahead every event of importance is pigeon-holed, every article in any paper noting an incident of interest is cut out and kept on a spindle with the date marked when it is likely to be available. Then there is a whistle at the speaking



(Courtesy of the Chicago Record.)

A LINOTYPE MACHINE AND OPERATOR.

The operator is at work setting "rush" copy. At the top of the machine is the fan-shaped magazine which holds the matrices of the letters. At the left, in the box and on the floor, are seen blocks of metal to be melted and used in casting the "line o' type," while at the left, near the top, is the large arm that reaches down and picks up the matrices for distribution after the line has been cast in metal.

tube in the local room; a man jumps to answer it; the city editor is calling for "Brown" or "Jones." That man hies himself to his superior's office, and here is given a definite "assignment" or job to go to this or that place and find out a particular thing. Sometimes some well-known man is in town; then he is told to "get a story out of him." There is no such word as fail when the city editor tells a man to do thus or so; failure means forfeiture of his position, and even though the city editor has been a reporter once himself and knows how impossible are some of the tasks set, yet he is never-relenting, and no excuses go.

When the man comes back from his assignment, he reports to his chief and is told to write so many words, to "play it up strong," or to "make it funny." After this is done, the reporter waits about the office for another assignment or the good news that he may go home. His "copy" or manuscript is sent up to the printer, and after being set in type is "proved" and copies of the proof come down to men experienced in correcting according to the particular style of the paper. Some phrases are never used on one paper that are of habitual occurrence on others. These "desk men" must see that all copy conforms to the paper's "style," and that nothing libelous is printed. After the proof is corrected, it goes back to the printer, who makes the correction in type, and then the article, or "story," as the reporters call it, is ready for its trip down to the stereotypers.

Photo-Engraving.

But possibly the story is of sufficient importance to need illustrating. No newspaper is complete without a corps of artists and a photo-engraving plant. Suppose the story is that of a great fire. At once the city editor on hearing the tap of the fire alarm in his office calls for reporters and artists to write up and illustrate the fire. The reporters get the news, while the artists with paper and pencil sketch the most interesting sights at the fire. This must be done in lightning-like hurry, for time is a great factor in newspaper work. On coming back to his office, the artist redraws in India ink the crude sketch he has made. This sketch is generally several times larger than it will appear in the paper, for the process of engraving reduces the size somewhat.

Zinc Etching

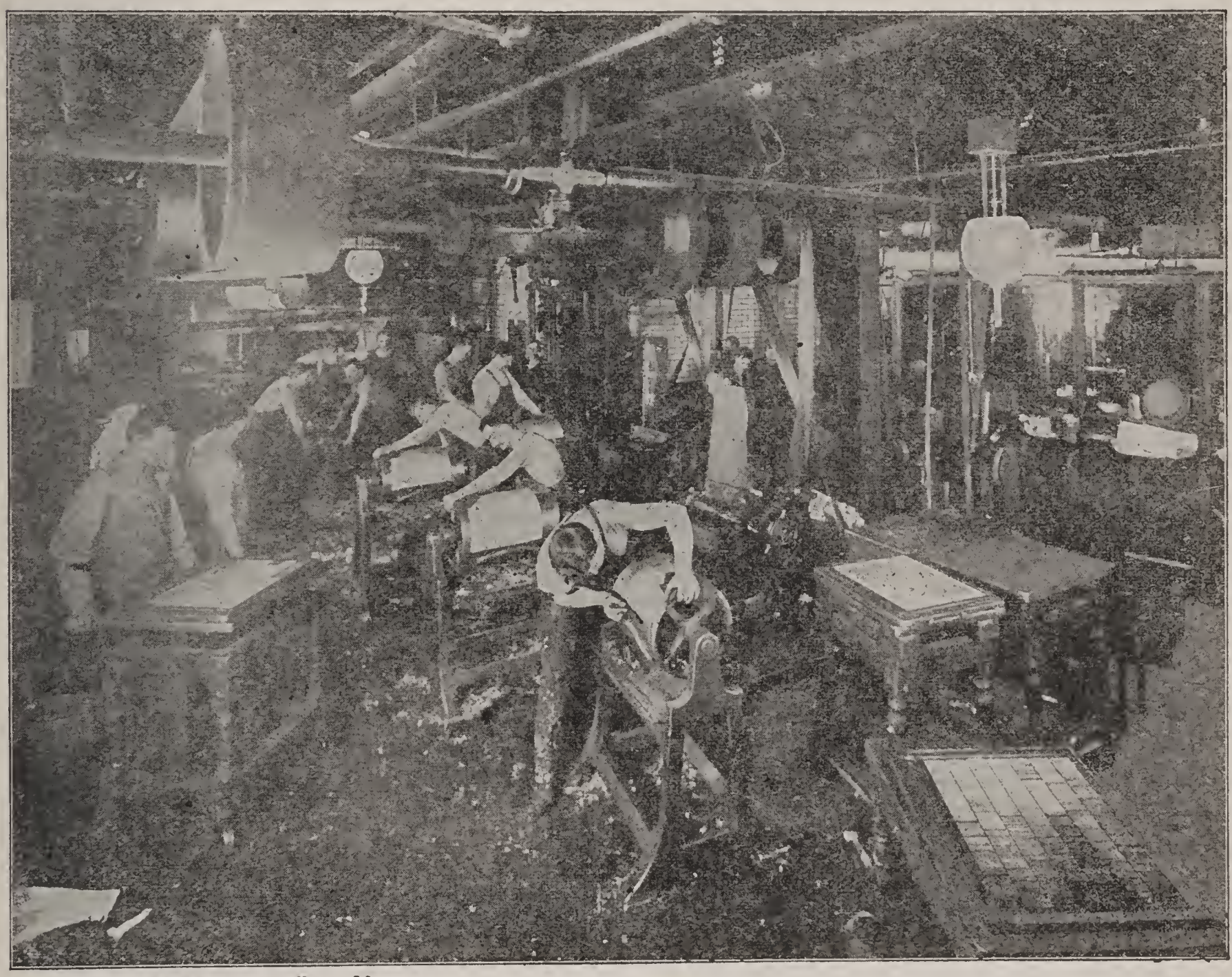
is the process generally employed in engraving illustrations for newspapers, because of the rapidity with which cuts made by this method may be turned out. The first operation after the picture has been drawn in black and white by the artist is to photograph it by means of a great camera on a "wet" plate. The camera and rack to which is fastened the picture when being photographed are both placed on a long board and hung by ropes or chains from the ceiling, a good deal after the manner of a painter's horizontal ladder hung by ropes from the roof of a house. This is done so that they will hold the same relative positions to each other, and if there is any jarring it will not affect the exposure. The exposures are generally made by the light of an electric arc lamp placed just back and to one side of the lens of the camera.

After a number of plates have thus been exposed, they are developed by ordinary photographic silver process. The use of "wet" plates is most important, for by this process the gelatine film which is wet may be stripped off from the lighter

glass used in the camera and pasted on a heavier glass for printing, several pictures on one plate. This heavy plate glass is then dried over a gas stove till the gelatine is perfectly hard. Now a sheet of sensitized zinc is placed behind this plate, and is exposed to an electric light, that shows up the lines of the picture. After this there is a treatment of

Nitric Acid

that eats away the exposed surface of the zinc plate and leaves the inked lines standing out. The plate is then treated



(Courtesy of the Chicago Record.)

STEREOTYPING ROOM OF A LARGE DAILY NEWSPAPER.

Showing the metal plates being prepared for the printing presses.

the same as one would print an ordinary photograph. The negative, being dark except in the places where the black lines of the drawing show in white lines, admits light to the sensitive zinc only along these lines. The zinc plate is now taken to the dark-room, where it is coated with ink and treated by a developing process to a shower of red dust called "dragon's blood," which is burned into it by placing the plate on top of a hot gas stove. The plate would now be almost good enough to produce a fair impression, but acid and burning are repeated four times, once for each side of every line. Then the eaten-out portion is made still deeper

by the "routing" machine, which consists principally of a little drill-like tool, driven rapidly by electricity, which bores down and scrapes away such parts as are likely to blur in printing. After this process, the etching is ready to be mounted on a metal base and sent to the printing form.

Other methods such as half-tones and color-processes are used at times on newspapers, but for general work the above-described process is in the main adopted. The time used in preparing an illustration from the moment the artist returns to make his final drawing till the cut is placed in the form is often less than an hour.

The Linotype Machine.

One of the greatest machines ever invented is that which does away with the old method of setting type by hand, substituting instead a device that performs with mathematical precision every act necessary for typesetting except thinking. Ottomar Mergenthaler, an inventor who recently died a millionaire, brought about this revolution by inventing the "linotype" machine, which, as the name would indicate, sets automatically a "line o' type." This machine, which looks like a huge typewriter, has for its essential feature the "matrix," while the keyboard, triggers, rollers, pistons, elevators, sprocket wheels, and levers work with such accuracy that the line of "matrices" is carried down to the box for the molten metal, there is flooded by the metal, and then each separate matrix is carried back to its respective little box, waiting for the next tap on the keyboard that will call it into use again. The matrix is a mold of a particular letter made of sheet brass, and varying in thickness according to the width of that letter. If you were to press a type into some wax or putty, there would be the reverse of that letter; just so with the matrix. At the top is a V-shaped cut made up of little steps, and at the side of the matrix is the imprint of the letter to be used. Each of the little steps in the V plays an important part, for they are different in each matrix, and after the line has been molded, these steps help in the automatic sorting of the matrices back to their proper places in the magazine. The operator sits before his keyboard something like the typewriter girl; he lightly taps a certain key, and there at once drops down from the magazine and falls into place near the metal box the matrix of the particular letter wanted. The keyboard is laid out the same as the type case of the old days, the "lower case" or small letters being on white keys, the "upper case" or capitals on black, and the punctuation marks on blue keys; separate letters not much used are kept in a little rack at the side, and may be put in by hand. The "typo" taps away on his keyboard until a bell rings that tells him a line is completed. He then pushes down a lever at his right side, and the line of matrices is picked up bodily, carried to a set of clamps, splashed over with hot metal, and then carried up by an elevating arm to the distributing part at the top of the machine. Here, by means of the little step-like grooves, each matrix is sorted out to its proper compartment by a machine somewhat on the principle of a sieve.

The Distributing Bar

extends along the whole length of the magazine, which is fan-shaped and divided into tubes all ending at the bottom in the little runway where the matrices come out. Beside the bar is a long revolving screw, and as the row of matrices come up from the elevating arm this screw pushes them along the bar. In front of the compartment allotted for

each letter is a special set of notches. As was said before, each letter has a set of little steps on the V-cut; these notches and steps agree for each particular letter, so that as the matrix of the letter "A" is carried along the distributing bar it can enter no compartment but that whose notches its little steps fit—just like the key that fits only one door.

100 letters.) There are men who can set even 10,000 ems per hour. Mistakes, of course, occur as in setting by hand, and the proofreader must send the matter back to be corrected.

In setting

Large Advertisements

and headlines only is the old method of hand setting now used. This is necessi-



(Courtesy of the Chicago Record.)

FOUR O'CLOCK A. M.

A crowd of newsboys waiting for their papers.

Hot Type Metal

is always kept in the metal box, heated by a gas flame. Knives trim the edges of the molded line of type to the exact size necessary. After the metal has been used once it is again melted up for more type. Typesetters can set as high as 7,000 ems, or matter to the amount of one newspaper column, in an hour, whereas it formerly took six hours. (The 'em" is the standard of type measurement; 100 ems is equal to the average

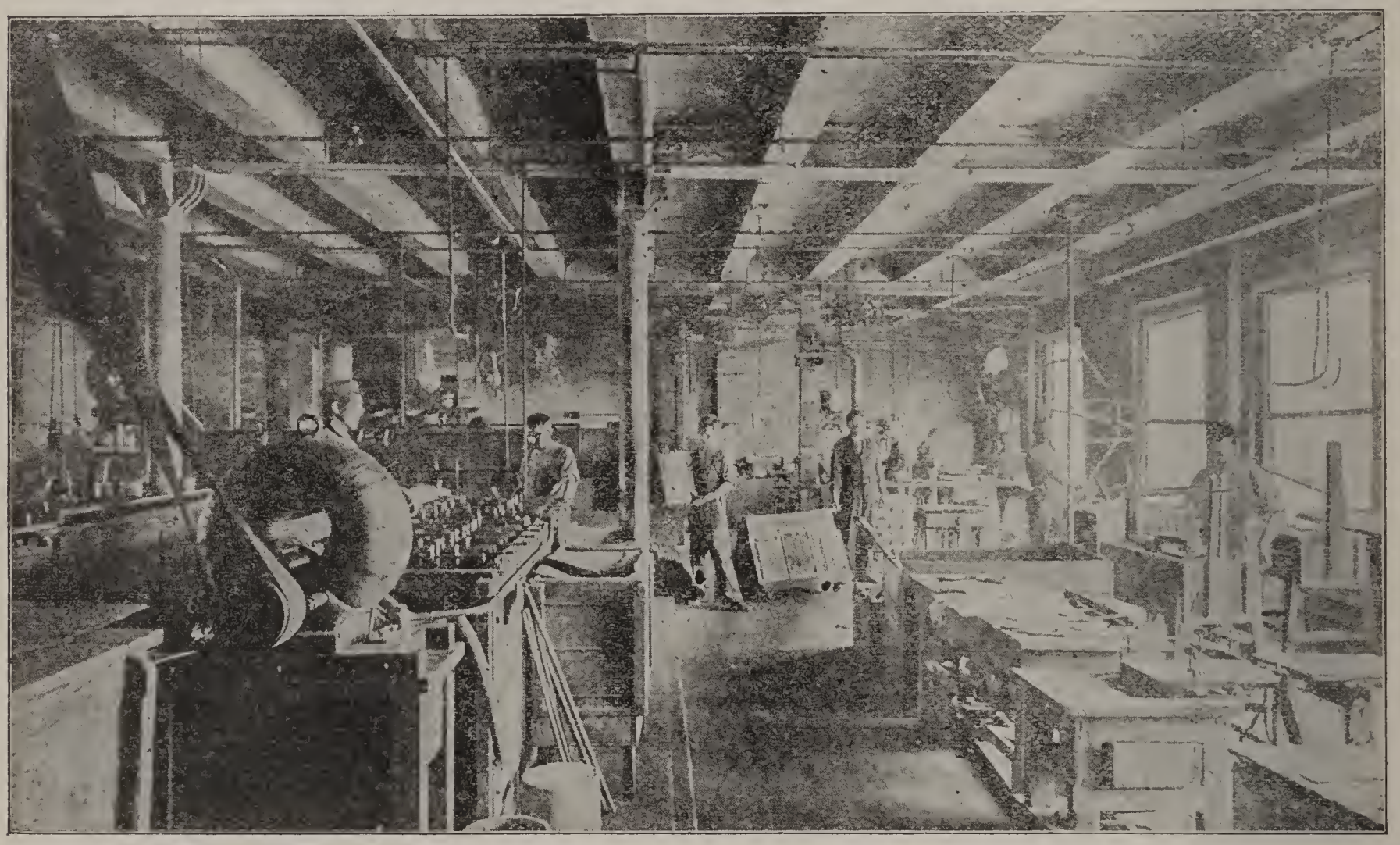
tated by the use of large and odd-sized type. And still the "ad" room of a paper is not the least interesting part of its plant. Here, on nights preceding a great "bargain day" of some of the leading stores of the city, many men, expert in style of setting up fancy advertisements, are kept busy arranging the most attractive displays of type for the reader on the morrow.

After all the advertisements and articles are set up in type, they are sent

to stone tables where men called "make-ups" see that each "ad" or story finds its proper position in large, square steel frames called "forms." In these the type is securely locked by screws so that the "form" may be sent down an elevator to the stereotyping room, where another process is gone through with before the press gets the work.

Stereotyping.

Each page is made up separately, and as the "chase" containing the type reaches the stereotyping room on the elevator it is at once placed upon the steam table to dry, for the "make-up" has used a wet sponge to dampen the type and make each line stick against the other, to facilitate in handling. From



THE FOUNDRY.

To the left, the electric battery; to the right the men are making an impression of the type in wax, and after the wax receives the coating of copper in the battery they take the copper shell and pour the metal into it—this is called casting.

Time was when we printed by simply bringing a heavy weight to bear upon the flat surface of the paper spread on the inked type. That was when printing was done by hand. When the style improved and great cylinder presses came into use, type in its ordinary form would not do, but great circular molds had to be made that could be placed around the cylinders. This process is called

the steam table, after the type is dry, the chase goes to a table where a "matrix" is made, only this matrix is not in brass, but in a sort of papier-mache. Sheets of tissue paper specially prepared are kept damp over night, and a sheet of this is now placed over the type. This is pressed into every little crack in the type and forms a reverse impression, which can easily be read. Then "backing" powder,

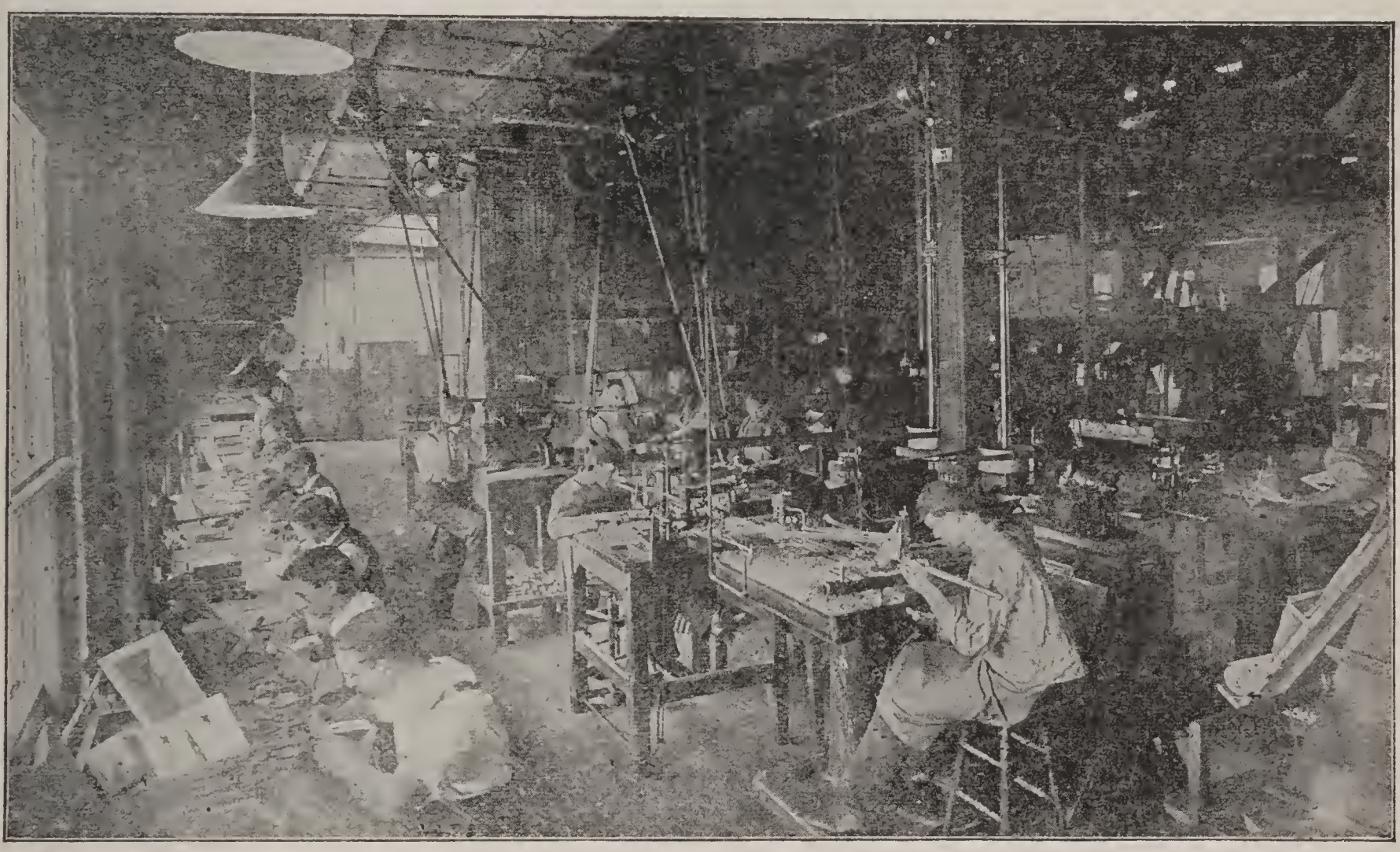
consisting of lime, flour and charcoal, is spread over the back and into the impressions, after which other paper is spread over and the whole affair is covered with heavy blankets and shoved under a heavy press heated by steam. Here it is allowed to remain until the paper has become hard and dry, when it forms a light, almost fire-proof mold that can easily be bent into the shape of a half-cylinder. Then the matrix is placed in the

Casting-box,

which is semi-cylindrical in form, consisting of two parts, one of which opens. The matrix is laid on the face of the casting-box, which bends it into the shape desired; the box is closed, the metal run in, and allowed partly to cool. While still hot to the touch, men with heavy gloves seize the cast plate and trim off the rough edges, and chisel out any imperfections. After this the plate is run under water to cool, and we have ready for the press a mass of metal the size of a page of a newspaper, seven-eighths of an inch thick, and curved exactly to fit the cylinder of the press.

Monster Presses.

The Hoe press is possibly the largest and best of the monster printing machines of to-day. They are quadruple in form, and are so ingeniously arranged that they take in paper in enormous rolls on spindles on one side of the press, print the pages, paste the pages together, cut each paper off at the proper time from the rest that is being fed from the spindle, fold the papers, count them, and deliver them at the rate of 48,000 four, six, or eight page papers an hour, 24,000 ten, twelve, fourteen or sixteen page papers an hour,



ENGRAVING HALF-TONES.

To the left of the picture are the finishers; to the right are the men that rout out the portion of the plate that isn't to print.

or 12,000 twenty, twenty-four or thirty-two page papers an hour. Each press needs floor space 22 feet long by 12 feet wide, and stands over nine feet high. The press is really two presses in one, paper being fed in from two rolls at a time, while the folder is really a separate machine connected and operated by the press. Each press has four 14-inch plate cylinders to which are attached by screws the stereotype plates. The cylinders revolve in the opposite direction to the impression roll, which is a heavy iron cylinder that presses against the plate and is covered with cloth. After a roll of

Hundreds of Pounds of Paper

is adjusted at the back of the press the paper web is run over a roller which smooths it out. Next it is grasped by the first impression roll, and it passes over the plate, receiving its first impression. Then the web runs downward to the second impression roll, where more is printed. Carrying tapes which guide the paper then run it up over the top of the press, where it is slit by a circular knife, and two wheels apply paste to the edges of the paper. Now the web is led to the folder over an angle-bar, and the mechanism is so perfect that the pages are all brought out in their proper position and the leaves cut. The other half of the press has been working in the same manner, either to make a complete paper like the other, or a supplement that is "stuffed" into the other part.

The Greatest Care

must be taken in operating the gigantic press, both to protect its delicate parts and the hands and legs of the men in attendance. One man holds a lever that starts and stops the press, others run about with oil-cans, lubricating every part, while others see that the ink is properly fed, and that the paper does not break or that a fresh supply is on hand. The cost of a Hoe press above described is $40,000.

From the maw of this great giant the papers are run in on little electric trolley cars to

The Malling and Delivery Rooms.

In "newsboys' alley" has congregated a crowd of urchins with their pennies ready to lay in a supply for their morning trade. Each has bought a check from a cashier which bears upon it the number of papers to which he is entitled. With this check he falls into line at the delivery window, and as his turn comes, he yells out the number. The man behind the window rapidly counts out that number, takes his check, and throws the bundle of papers at him. So quick is the whole process from writer to street boys that "hot" news brought in at half-past two in the morning is in the hands of the early riser at four o'clock. But there is yet the subscriber living at a distance who must be supplied with his particular morning favorite. As soon as his name is entered on the subscription list, this list is sent to the printer, who sets it up in type. From this is printed upon long strips of yellow paper the names of every subscriber who is to receive a paper by mail. The printing includes with each name the post-office and street address, together with date of expiration of the subscription. These strips are set into still larger strips, and sometimes pasted together, so that by a clever little device called a "mailing" machine, in the hands of skilled "mailers," each little label is carefully gummed, cut off from the strip, and with a slap is pasted on the outside of the paper, thus telling the postmasters its destination.

This process is, however, only for the single subscribers; for the dealers there have been prepared early the evening before large wrappers with their proper labels for sending, together with the number of papers to be sent, plainly marked on the outside. So when the time comes for wrapping, each mailer can rapidly count out the desired number, apply paste to a number of wrappers at once, hurriedly roll up the bundle and throw it into the sack for a particular train.

All the "galleys" of printed lists of subscribers and dealers out of town have been arranged in geographical order, that is, all those going to one town are on the same list. This greatly aids in sending out to the trains, for as soon as one strip is done, that bunch of papers is put in a bag ready for that town or train.

Business Departments of the newspaper are where all other details are thought out. Advertising must be obtained which will bring in money to support the plant and make money for its owners. Schemes must be worked out to induce customers to buy this particular paper instead of some competitor. Enormous contracts for buildings and machinery must be let; new devices developed that will increase the reputation of the paper; correspondents abroad hired and paid; press associations formed with other papers for the protection of their general interests. And when one stops to consider how vast are some of the American journals, with several issues each day, and great magazine-like editions on Sunday, with circulations that run nearly to a half million copies daily, the nature of such stupendous business enterprises may be imagined.



THE FINISHING DEPARTMENT OF AN ELECTROTYPE FOUNDRY.

Death-Dealing Machines of War

HOW THE ARMIES AND NAVIES OF THE WORLD FIGHT TO-DAY AS COMPARED WITH METHODS USED ONE HUNDRED YEARS AGO.

Huge Floating Arsenals; Shells Fired Eight Miles; Smokeless Powder; Torpedoes and Submarine Mines.

IT has been said that improvements in deadly war missiles will before long put a stop to war altogether. One would almost think so when it is considered what marvelous strides invention has taken along this line. Time was, and not long ago either, when the round cannon shot was aimed at the tough oak side of the frigate; when the grappling chain and cutlass for hand-to-hand conflicts were necessary on all war vessels, and the bayonet and cavalry charge played great parts in land battles. Most of this is now changed. The iron shot gave way to steel projectiles, as the wooden hulls were replaced with steel. The completeness of victories, however, is no less than in centuries past; distances are only greater. And each increase in the power of improved explosives and projectiles will be met with greater defensive devices, and with greater distances between the firing lines. It will be the brotherhood of man, not the deadliness and fear of weapons, that will bring about universal peace.

To-day, in land forces there are such improvements as the far-reaching rifle, with its nickel-capped bullets, the Gatling, Maxim and Hotchkiss guns, smokeless powders, and such explosives as cordite, dynamite, lyddite and nitro-glycerine. Charges play some part, as in the gallant fight of San Juan Hill, but, in the main, artillery and long-distance firing prevail. With the navy more marvelous improvements have been made. Nearly everything on board ship can now be operated by electricity. Ships are lighted, torpedoes, guns and mines fired, searchlights are operated, torpedo-boats propelled, and a hundred other devices all controlled by this weird agent.

The armor plates of the modern vessel are thick and of the hardest steel known, yet they are readily pierced by the enormous shells thrown at the distance of several miles from the throats of great dynamite and compressed air guns. Among the numerous

Explosives of High Power

that are coming into use, the newest and possibly the most powerful is lyddite. Like others of its class, such as dynamite, melinite, cordite, maxinite, etc., it is picric acid brought into a dense state of fusion. Picric is obtained by the action of nitric acid on carbolic acid. When lyddite shells explode they grind their outer coverings into small fragments, and with a noise like the downfall of the heavens, tear everything to pieces for yards around. This explosive is being used now by the English in the war with the Boers, though the latter have complained that such is against the codes of civilized warfare. General Kitchener also used it in his campaign of the Soudan with tremendous effect. A shell was dropped into a mosque at Omdurman,

where 120 Mahdists were worshiping. The mosque and its inmates were

Blown Into Pieces,

and only twelve of the worshipers escaped alive. In the war between China and Japan, cordite, a similar though inferior explosive, was thrown in a twelve-inch shell into the Japanese flagship Matsushima with the effect of hurling a 4.7-inch gun from its mounting, firing a heap of ammunition, disabling two more 4.7-inch guns, and killing and wounding ninety officers and men.

Smokeless powder is another deadly explosive, having for its main peculiarity the quality of exploding without smoke, giving off only a slight violet vapor, that is not sufficient to betray the ambush of the gun. This kind of powder is made in long cylindrical strings and then cut up into small pieces. In the United States war supply factories, it is coated with plumbago by being placed in receptacles with the powdered black lead or plumbago and shaken up. This coating, being rather oily, keeps the powder from igniting by friction in case of rough handling. Cordite looks a great deal as its name would signify, something like brown jelly pressed into long strings from one-sixteenth to one-half inch in diameter, and dried. Some kinds of smokeless powder look for all the world like carefully cut strips of slippery elm bark. It is made in slabs about one-fourth inch thick and a foot and a half to two feet long. This powder is much safer to handle than common black or brown powder, and will bear quite a blow provided no sparks are struck. Like all smokeless powder, it will burn without special danger if a match is applied to it, with a clear, steady flame, not flashing with a big s-s-s-s like the old sort. Some of these explosives are cut into pieces just like Saratoga chips, and it is a rather blood-curdling job for one not informed to watch shell-loaders hammer home this stuff into the big shells as though in truth it were only so much potato.

Nitro-Glycerine,

which is used in some of its forms for war purposes, but more especially for blasting oil-wells and the like, is one of the most difficult of all explosives to manufacture. It is generally pale yellow in color, is odorless, and has a sweet, pungent taste, though when touched to the skin will cause severe headache. It is made in a large tank called an agitator, which has a set of revolving paddles. Into this are poured equal quantities of nitric and sulphuric acids, and after a mixture of 250 pounds is secured, sweet glycerine to the amount of 1,500 pounds is added. The chemicals naturally tend to come to great heat, but since ninety degrees explodes the mixture, water pipes are arranged about the vat to keep down the temperature. In carrying this explosive there is great danger of jarring. Makers of the stuff generally live only about five years at their work. As in all other factories of powders and the like, no metals are allowed, and the shoes and clothing of the workmen must be changed to suit their employment. Canvas shoes are used, and the men may not turn their trousers at the bottom for fear of bringing in grit and gravel that might strike a spark.

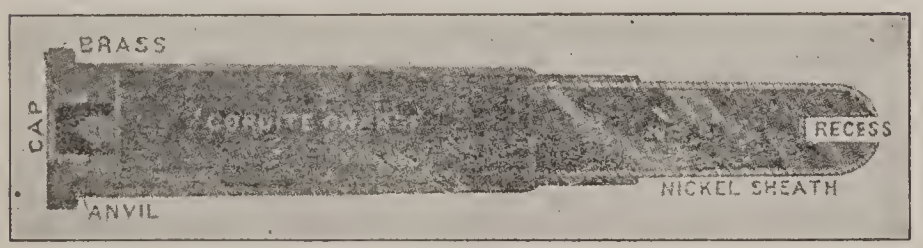
Projectiles

have improved in weight and hardness so that now in battles tons of metal are fired through great granite fortifications and steel clad ships with greater ease than the old-time round shot could pierce an oak side. Early in the present century methods for throwing hollow shells filled with powder or small shot were invented. From canister, grape and chain shot, there have evolved heavier shells, gener-

ally explosive, but also of such hard and sharply pointed steel that no armor can withstand them. Most of the smaller rifles are equipped with balls that pierce the object aimed at cleanly and without jagged edges. Cases have been known where such a ball passing through a person did not even inflict a severe wound. Such is really the result aimed at in civilized war; either to kill a man outright, or simply temporarily to disable him. Some kinds of shells, however, are diabolical in their intent. Among these is the

Dum-dum Bullet

recently declared barbarous by the Peace Convention at The Hague. Some small shot explode after entering the body;



THE ENGLISH DUM-DUM BULLET.

The recess in the point of the bullet allows the soft lead, of which the interior of the bullet is made, to expand on striking the victim's body; while the nickel sheath breaks into jagged edges and makes frightful wounds.

others, like the dum-dum bullet, flatten out when they strike any object of resistance, because of their soft material, being only partly covered by a nickel envelope, and these at once make fearful, jagged wounds, and are hard to extract. The British are now using in South Africa an awful affair partly covered with copper, but bare at the end, and with a slight opening sawed down into the bullet. When this strikes a victim, the cut closes because of its softness, and the bullet then assumes the shape of a mushroom, as a result making terrible and painful wounds. One of the new inventions along the line of projectiles is what is called

The "Base" Shell

The bottom or blunt end of the shell, which is large and for cannon use, is separate from the rest of the shell. This "base" rests on ball-bearings, and, while the upper portion revolves, it is stationary. Attached to the base and folding up into grooves along the upper part are four murderous scythes. When the shell is thrown from its gun, the rifling of the core starts the point of the shell revolving, the knives, pushed by springs, jump out from the sides of the base, and as they go through the ranks of the enemy cut and maim every man in their course. Then, after its work is nearly complete, it explodes and works more havoc. The knives when outspread cover a diameter of forty-five inches, and it may be imagined what carnage such a missile will create in a rank of closely lined infantry.

Searchlights

have brought about a great revolution in warfare. By their means lights and signals can be thrown many miles, and the work of the enemy in the night detected. The average searchlight is made up of lenses and reflectors so as to condense or diffuse the light of a 25,000 candle-power electric arc lamp. They are made in the shape of a cylinder about thirty inches deep and from two to three feet in diameter. In the back is a silver-backed reflecting lens, and at the front is a glass door. Within is an electric lamp placed at the focusing point of the lens. Between the glass door and the lamp is a smaller reflecting lens that throws the light of the electric lamp into the large lens, and that lens in turn throws the concentrated rays out through the glass door miles and miles into the night. The whole affair is mounted on a pedestal, and can be moved in any direction at will. The rays of light are generally kept together so that a beam 3,000 feet away

covers only the width of fifty feet. This, however, can be changed at will if desired.

Torpedoes

are the dread of all war vessels, and work as much havoc as any other weapon. They are shaped like a cigar, with propeller at the rear and an awful load of dynamite or gun-cotton at the nose. Inside is an electric storage battery attached to a motor that operates the propeller. When ready to be discharged at the enemy, a torpedo is placed in a compressed-air device that shoots it out into the water, aimed in a certain direction. The electric battery has been turned on and the rudders so arranged that the torpedo will travel in a given angle. It drives forward at a great speed, the cap on the nose strikes the side of the ship and discharges the explosive, and the ship is torn into pieces.

Mines are used nowadays for protection of the harbors against an incoming enemy. These are big bombs placed at the bottom of the harbor or straits and connected by electricity so that they may be fired off at will. Charts are made of the harbor, and so figured out that the attendant several miles away can look through a telescope at the approaching enemy, and can tell at just what moment the intruder is over a given mine. He then turns a switch, and the great vessel of steel and iron is blown into the air with a vast volume of water, and rapidly sinks. Some mines are fast to buoys which float at the surface, so that when a vessel coming into the forbidden waters strikes one, an electric spark is carried down to the mine and it explodes.

Among

Machine Guns

the Gatling, Hotchkiss and Maxim are the deadliest because of their rapid fire. The Gatling has a number of barrels joined together side by side, and at a distance looks like a big stubby cannon. There are generally about ten barrels, which revolve upon a pivot. Each chamber has a separate lock which is discharged automatically when the barrel reaches its proper position. The machine is worked by a crank; the cartridges are placed in a rack with grooves that let them slide down into their proper chambers as soon as the fired shells have been ejected. As many as 1,200 shots a minute have been fired by the Gatling gun.

The Maxim differs in that it is wholly automatic; after each recoil of a previous discharge the shock opens the breech, extracts the empty shell, takes a fresh cartridge, cocks the gun, pushes the shell into its chamber and fires the gun. The cartridges are loaded into the gun in a belt, and all the operator has to do is to pull the trigger the first time, and the belt is ground through the machine at the rate of 600 shots a minute.

The Armstrong gun is the largest of the rapid-fire guns. It is for large caliber shells, using 4½ pounds of smokeless powder, and throwing six-inch projectiles weighing 100 pounds with enough force to penetrate fifteen inches of wrought iron. A smaller gun of the same order fires forty-five pound shells at the rate of fifteen per minute.

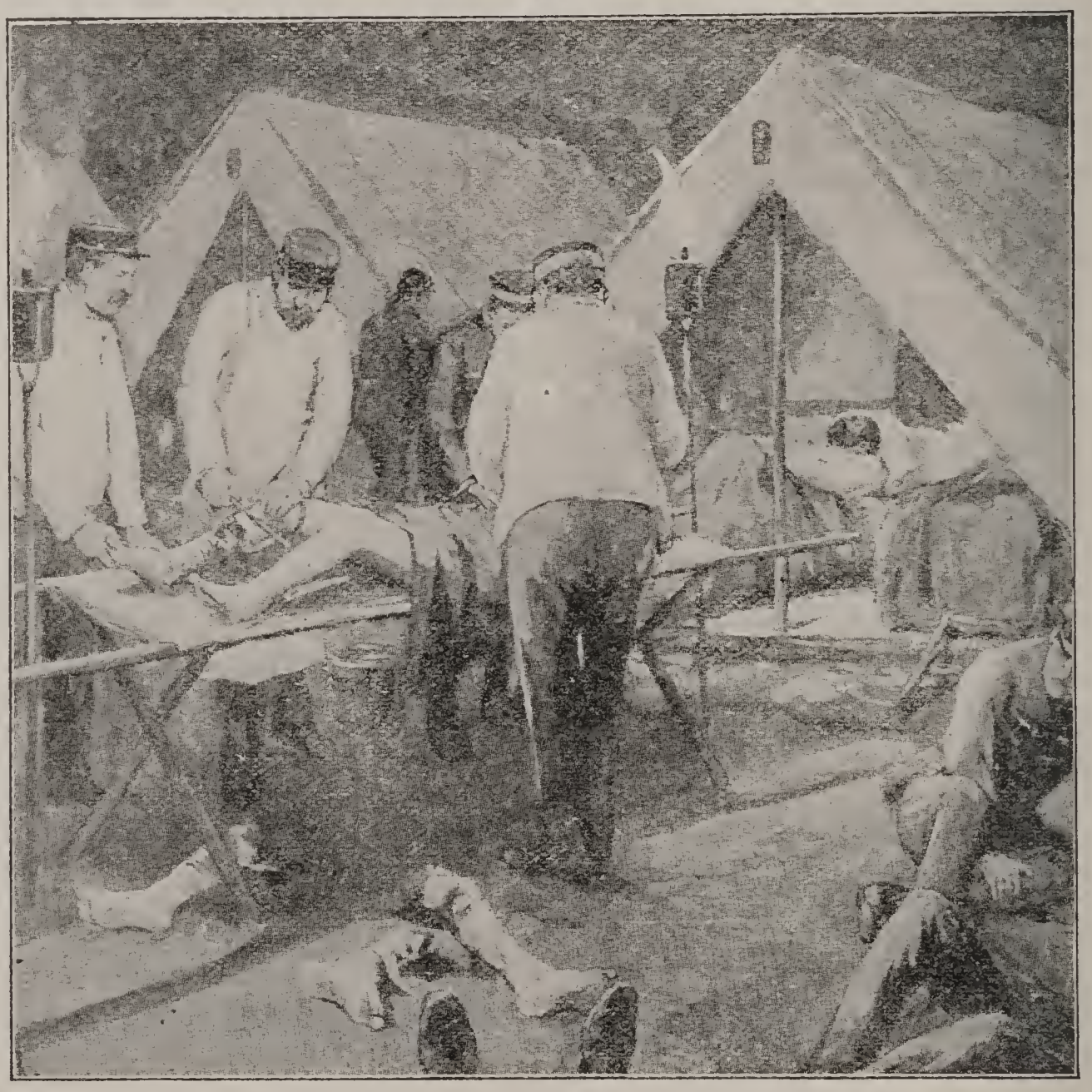
The Driggs-Schroeder and Hotchkiss rapid-fire guns are inventions of Americans, and are used largely on our battle ships, especially in the "fighting tops." These swing on pivots, so that they may be directed to any quarter. They fire one shot at a time, and to aim the gun an arm-piece similar to that of a rifle is attached. The gunner presses this against his shoulder and steadies it, while his two hands remain free to open the chamber, insert a shell, pull the trigger, and reload. It fires still projectiles with great

force and at the rate of thirty-six shots a minute.

Enormous strides have been made in the upbuilding of the

American Navy

since the Spanish-American war. Many new craft have been added, but in the battleship class the effectiveness of our fighting ships has been prodigiously increased. Six new monsters of the finest type are under way: the Kearsarge, Kentucky, Alabama, Illinois, Wisconsin, and the new Maine. The measurements of the Kearsarge and Kentucky are: Water-line length, 368 feet; displacement, 11,525 tons; speed, 16 knots; horse power, 10,000; water-line armor belt, 16½ inches; side armor above belt, 6 inches; turret armor, 17 and 15 inches; conning tower, 10 inches; protective deck, 2¾ inches. Armament: Main battery, 4 thirteen-inch guns; submain battery, 4 eight-inch guns; secondary battery, 14 five-inch rapid-fire guns, and 20 six-pound rapid-fire guns. The enormous projectiles thrown from the main-battery guns weigh 1,100 pounds, leave the muzzle with 33,627 foot tons energy, and have the power of penetrating 34½ inches of wrought iron.



CARING FOR THE WOUNDED.

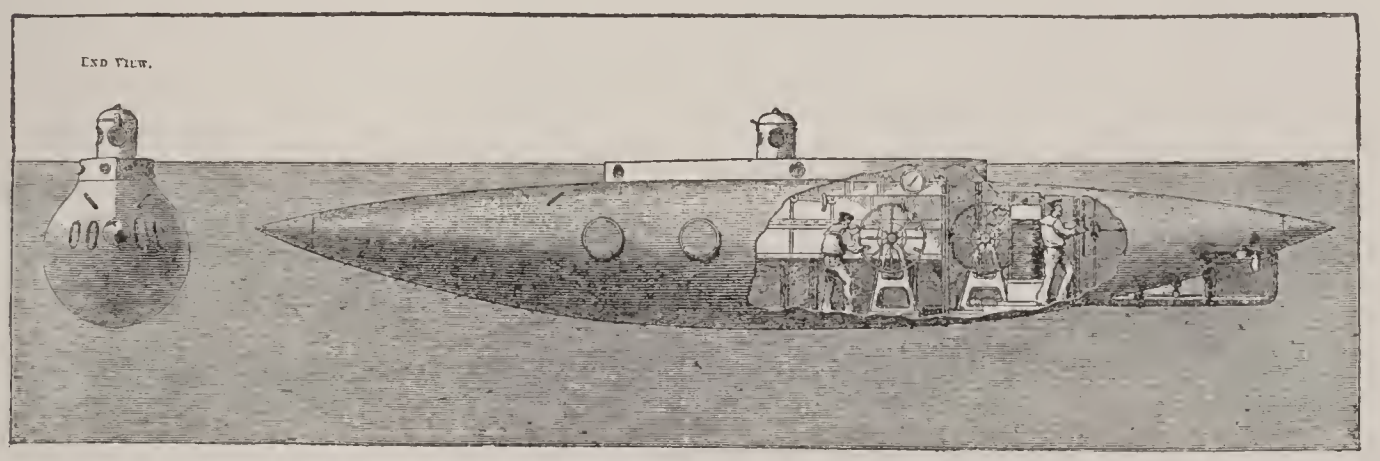
A scene in a modern U. S. field hospital during the late war with Spain.

Besides the heavy war vessels, the navy is being equipped with a new class of peace ships. Six cruisers are soon to be built that are not intended for battle with war ships of the enemy. Their duties

will lie in capturing or annoying the merchantmen and unprotected harbor towns of the enemy, and policing the sea. They are especially adapted to tropical waters, carry plenty of coal, and are light enough to enter shallow water. They are to be built of steel, but their bottoms and sides up to a minimum of two feet above the water line are to be sheathed with heavy planking, which in turn is to be covered with copper. This copper covering is to avoid barnacles and the like which grow on the bottoms and sides, and materially hamper marine movements. Very little wood is to be used on the vessels, for it has been found that breaking beams splinter and cause more wounds than bullets. They will measure 308 feet 2 inches over all, 53 feet wide; full draft when loaded, 16 feet 8 inches; displacement, 3,400 tons; horse power, 4,500; coal capacity, 700 tons, and speed 16½ knots. All the latest methods of electric lighting, heavy engines and the like will enable them to carry crews of 290 men 9,800 miles without other supply

The Largest Searchlight

ever made is the one that was exhibited on the roof of the Manufactures Building at the World's Columbian Exposition, and which is now installed in the observatory on the summit of Mt. Lowe, California. It has the power of 3,000,000 candles and throws a strong light 150 miles. Its reflecting lens weighs 800 pounds, is three-fourths of an inch thick at the edges and one-sixteenth in the center, and is encased in metal rings weighing 750 pounds. The whole light is 11 feet high and weighs 6,000 pounds, yet is so delicately poised that a child can move it in any direction.



SUBMARINE BOAT WORKING BY ELECTRIC POWER

"SKYSCRAPERS."

THE MODERN PUEBLO VILLAGE; WHOLE TOWNS IN THE TALL BUILDING OF TO-DAY.

TEN years ago, when the first "skyscraper," the Tacoma building, was begun in Chicago, it was supposed that the Pyramids and a few of the great cathedrals were the largest buildings that were likely ever to be erected. To-day we have tall bridge-like edifices that almost overtop these landmarks and seem to brush the skies. The development of the tall building generally known as the "skyscraper" came about in the natural course of improvements in building, but it has wrought one of the greatest revolutions, though peaceful, that has ever been witnessed.

When land values in the great cities began to go up several figures at a jump, the question was asked, "Where are we going to conduct our business?" Land was occupied in the mercantile centers, and since the buildings could not spread out they must increase in height. This went on in a meager sort of way, for people did not like climbing up several stories to their offices. Then came the elevator, and with it the study of how best to increase the height of the office buildings.

It had always been supposed that the walls were the main support for the floors and the rest of the structure, but one day an engineer came along who reversed this method. He argued that by making the framework of steel and fastened together like a cantilever bridge, there ought to be strength enough to support the outside covering. And such has been the method of building since, called

"Chicago Construction."

But the problem was not nearly worked out, for with increased height there must be increased strength in the foundations. This meant a study of the soil to see if it would bear such great weights, and what would be the best method of keeping the structure from leaning out of plumb. The result has been that building has now become almost a branch of civil engineering.

Let us observe the rearing of one of these cities in miniature, with its railway-like elevators carrying thousands of passengers and freight daily, with its own electric light and power plants, its restaurants and hotels, its libraries for the tenants, its telephone "central" and telegraph lines, its laundries, fire apparatus and trained fire departments, barber shops, postoffices, superintendents, detectives, and corps of workmen.

The Tallest Building

of to-day is the Park Row, in New York city, designed by R. H. Robertson. It is twenty-nine stories in height and measures from the bottom of its foundation to the top of its flag pole 501 feet, or nearly one-tenth of a mile. Its weight is about 20,000 tons, and when loaded with its "live" weight of tenants, furniture, etc., the total pressure upon the founda-ion

piles is about 61,400 tons. It may well be imagined what is the amount of steel, stone, bricks, cement, glass, etc., that is needed in the construction of such a monster, and yet the rapidity with which these buildings are erected is still more amazing.

First the soil is probed to see of what nature it is. In Chicago,—which, by the way, is almost a floating city because of the thin crust of earth that rests on a large bed of ooze,—the building problem is different from that in New York, where the ground is largely sandy with rock bottom.

Great Pile-Drivers

with hundred-ton hammers, pound down into the ground to great depths long pine piles, sometimes, as in the Park Row building, forty feet long, and as many as 1,200 in number. The piles are placed about two feet apart and in rows that will be directly under the great vertical columns that are to support the great weight of the completed building. On top of these piles and about their upper ends is poured concrete, which hardens and becomes a solid rock-like substance, resting securely upon the piles. Sometimes criss-cross arrangements of steel rails are imbedded in the concrete, and, when it has hardened, there is presented as a first foundation a mass of steel and rock that it would seem no force or time could conquer. Resting on this sub-foundation are huge blocks of granite, and above them the brick piers of the building. The weight of



A MODERN "SKYSCRAPER."

Showing the framework up, and several floors laid. Ready to put on the walls of the lower stories.

the building is not allowed to come directly on the granite, but huge steel beams, some of them eight by fifty feet, and weighing more than fifty tons, are placed between the foundations and the bases of the upright steel girders about which the "skyscraper" is to be built. This distributes the weight to every part of the foundation. Above the surface a great steel framework rises, which, before the walls are on, looks a great deal like an immense house of cards.

The enormous steel girders that make up the frame are all riveted together in every available place. It is said that if a storm great enough to disturb one of these skyscrapers came along the building would hang together, even if it were blown entirely over. The outer walls of this great box-like frame are very thin when compared to its height. If the old method of using the walls as support for the floors were used, the walls at the bottom would have to be so thick that there would be no open space for use, while the weight would be so great that no foundation would support it. The material varies; often it is of terra cotta, and sometimes of brick and stone. It is fastened securely upon the framework, and the lower walls give but little support to those above.

The floors are made, as are also the walls, entirely of hollow,

Fireproof Brick;

and some buildings have not even wooden laths, but rather arrangements of thin steel or tin upon which the plaster is laid. Thus a fire may burn out the fittings of one room, yet not spread to another.

The cost of the Park Row building was $2,400,000, but the income from its rents is more every year than the taxes of a small city. It contains 950 rooms, and will accommodate tens of thousands of people. The elevators carry over 50,000 people daily.

The question whether the "skyscraper" has reached its limit is not as yet answered. Cities are enacting building laws regulating the height of buildings. Fires disastrous in their results have recently broken out in New York, which threatens the increase of height. It remains to be seen whether steel will last long enough without rusting, though at present, examinations of steel girders erected ten years ago show no such decay. Whatever the future of the tall buildings is, all modern improvements in buildings take on the aspect of the "skyscraper."

Compressed Air and Pneumatic Tubes.

HOW MAIL AND EXPRESS PACKAGES ARE SENT MILES UNDERGROUND BY AIR ALONE.

AIR compressed into a smaller space than it normally occupies exerts a powerful pressure, for being a gas of a certain density it needs a certain amount of room. When, then, by means of a compressor or pump we force air into a small receiver the tendency is for the tiny atoms that make it up to push one against the other for more room and try to get away. This powerful agent is easily obtained, and when stored up in tanks may be used in any one of some hundreds of ways. When conducted through a pipe with a faucet nozzle the air may be used for blowing dust out of carpets and upholstery, as well as for applying paint to high ceilings. Chemical experiments are made daily with its aid. Power is applied for running cars, elevators, automobiles, electric dynamos, and many other such affairs. Liquid air was discovered only by its aid, and the great system of sending packages in pneumatic tubes from floor to floor of the great department stores, mail from city to city, and messages underground from the great press associations to the newspapers, saves much time and expense. Recently a pneumatic tube system was opened between the New York City postoffice in the city hall at New York with that of Brooklyn. A tube eight inches in diameter and over a half-mile long passing over the Brooklyn Bridge thus hourly saves the use of many wagons and messengers. Possibly as fine a system as any is that which was recently installed in the Waldorf-Astoria Hotel in New York City, though the placing of the tubes in the walls of the building is a great deal easier than running them under the ground in conduits, as are those that connect all the great newspaper offices with the telegraph companies.

This great hotel has 1,200 rooms, and on an average entertains 1,500 guests; it is sixteen floors high, so that it may readily be seen what an army of pages and clerks it would take to sort and deliver 6,000 pieces of mail and 2,000 newspapers that are received every day, without the aid of some such device as its pneumatic tube system. In the basement of the hotel is a

Pump-Like Engine

that compresses the air to a pressure of from two to three pounds to the square inch. The compressed air is stored in a large tank, from which run two large mains or pipes, one to the "central" station on the main floor, where the boxes are shot up to the different floors, and another that leads up to the top of the building. The latter has fourteen

branches, one leading to each of the first fourteen floors, each one ending in receivers specially adapted to the system. These two mains and their branches supply air under pressure to the other tubes that are to carry the messages. Now, leading from each station on the upper floors down to the "central" on the main floor are separate transmission tubes made of seamless brass tubing three inches in diameter, which do the carrying. Thus, at the main station there is a long row of receivers, fourteen in all, each numbered and leading to its respective floor. Little boxes to fit the tubing, and having fur on the ends so as not to stand still and let the air pass around them when in the tube, are employed to shoot through these pipes, while longer ones ten inches in length are used for carrying newspapers. When it is desired to send up mail or a visitor's card to an occupant on an upper floor the attendant at "central" places the message in one of the boxes, shoves the box into the receiver, and then pushes a rod which in turn actuates machinery that lets a little air into the tube. This causes a current sufficient to carry the box up to the end of its tube, where it is dumped out. The attendant at this station hands the message to a page in waiting, who carries it to the proper room.

Some systems have two sets of pipes through which all the time there is flowing a strong current of air, one pipe leading up, the other down. This, however, is done away with by the system just described, one tube sufficing for messages either way. On election nights when newspapers are rushed to get the news, and thousands of telegrams are being sent and received hourly, this is the only method which could be used.

Modern Illustrating.

HALF-TONE AND COLORTYPE ENGRAVING.

ASIDE from the method known as zinc-etching (see article on Modern Newspaper) there are several other processes, such as wood-cuts, half-tones and colortypes. Wood-cuts, as their name implies, are engravings on blocks of wood, and are of the earlier method of engraving. With these very fine detail in lights and shadows can be obtained. but for rapid and inexpensive work the photo-engraving processes are used in the main. The zinc method for outline cuts, or cuts where there are no other tones or colors other than black with the blank space white, is as good a process as could be desired, but it can readily be noticed that in reproducing photographs there are some shadows more intense than others and some lights brighter. Zinc etching cannot

possibly bring out anything but white and black, so the half-tones or lighter shadows had to be produced by some other method.

It was found that by photographing the object desired through a fine screen of muslin or

Wire Gauze

or lines scratched on a glass plate and then filled up with ink, the little squares in the screen would separate the rays of light according to the strength of the light or shadow of the picture. Where the shadows are intense the rays run together so that the effect on the plate is of the black shadow running all together, but where they are lighter the rays come upon the plate differently and form little dots, while in the high lights or white places the plate is still more dotted. If you will take a magnifying glass and examine a half-tone you will see that the whole picture is made up of little cross-bars. This is the effect of the screen, and is called "stippling." The screen is placed just in front of the plate to be photographed upon in the camera, and as the rays of light come in through the lens they are diffused according to the intensity of the light or shadows in the object being photographed. The screen is ruled in little bars with lines from 80 to 150 to the inch. These are so small that they hardly appear as lines when the cut is viewed a little ways off, yet they accomplish the work of collecting the different grades of half-tones, and produce a picture after being etched on copper or brass plates almost a counterpart of the photograph.

The Colortype

is worked out on the same line, that is, with a screen to stipple or grain the plate, but a further process of using different colored inks is used which in the end gives the effect of photographs in color. The process consists in having three different half-tone plates made of the same subject, which are used respectively with three different inks: red, yellow, and blue. These three colors when combined in proper amounts by printing one on top of the other will give any shade of color desired. The subject to be printed is carefully studied as to its color, and the proper combination of the inks to produce the desired colors is decided. Then one plate is arranged for printing, let us say, in blue. All that portion of the picture that is to appear in heavy blue has a heavy surface on the engraving; the lighter shades are stippled more, or eaten out; while that portion which needs blue in combination with one or both of the other colors is shaded in proportion. This plate, after being "blocked" with color thus, is marked near the edges with

"Register Marks"

which aid in printing the next color exactly on top of the other at the proper place. Then the yellow plate is prepared in the same manner, and then the red. Proofs of each plate are taken separately and together, to see if the right color scale has been worked out. If the final proof is correct, all the register marks on the several plates should print exactly one over the other and not blur, forming a single mark. When this is done, we have as a result a perfect colortype or picture resembling a photographic half-tone, only in natural colors. The greatest difficulty in this kind of engraving is that the operator must thoroughly understand the effects of one color upon the other, and be able to know what degrees of intensity of the primary colors must be used to combine at last into the perfect and natural shade.

The Meat Market of the World.

The Union Stock Yards, of Chicago, Where Millions of Dollars, Worth of Cattle, Hogs, and Sheep are Slaughtered Daily and Shipped To Every Quarter of the Globe.

CHICAGO supplies the world with meat. Daily there passes through the great Stock Yards on the southwest side of the city millions of dollars, worth of cattle, hogs, and sheep, beside vast numbers of horses, to be shipped to all parts of the globe. These yards gain their name by reason of the numerous railway lines that surround them in a square, and which bring here from all parts of the stock-raising country vast herds to be slaughtered and packed.



"KNOCKING" CATTLE IN THE KILLING PEN.

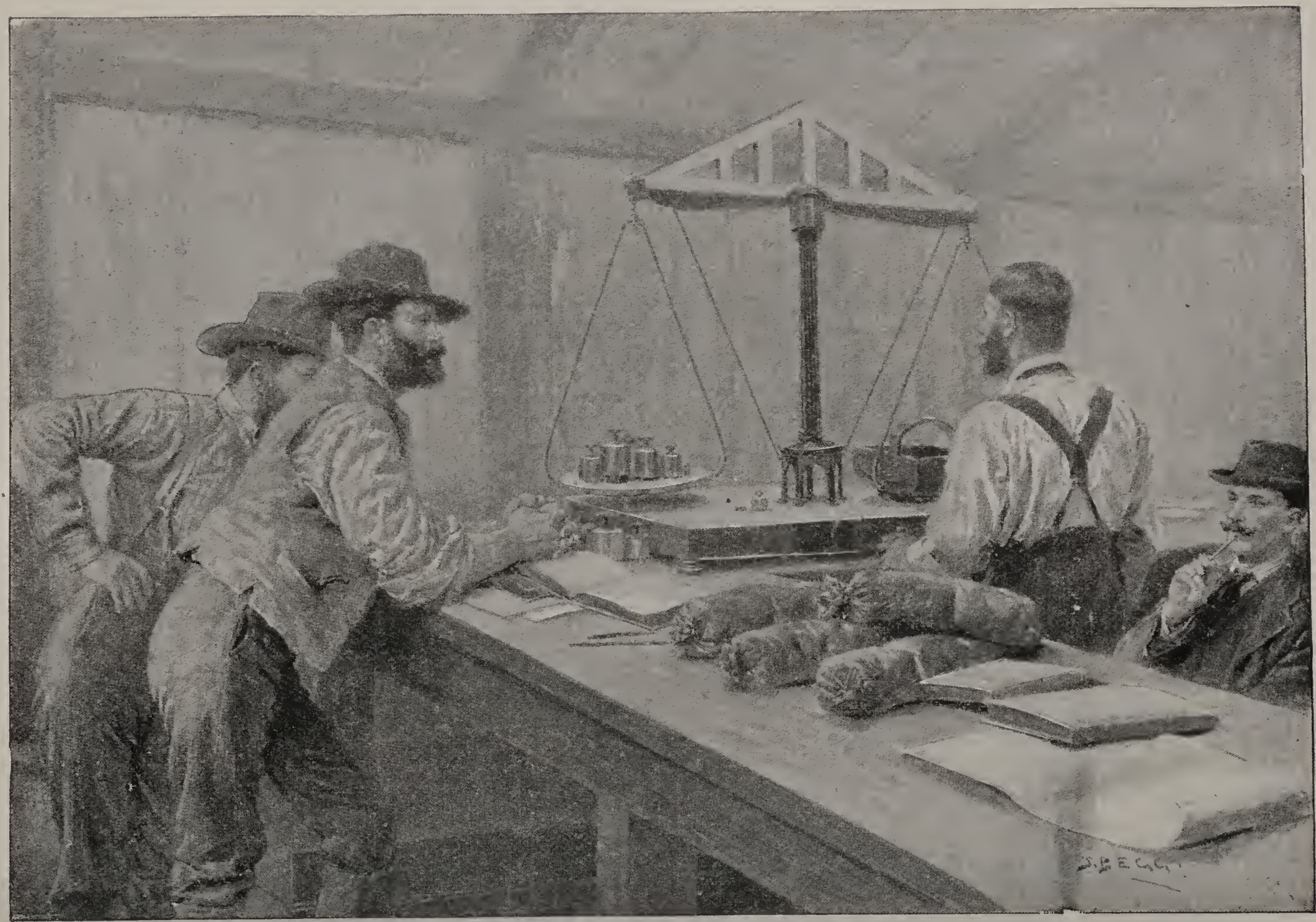
The Union Stock Yards is a corporation, virtually a monopoly, and has many of the powers of a municipality. Within its gates enter every morning, between 4:30 a. m. and 9 a. m., some 28,000 persons, while there are employed in both the yards proper and "Packington," which is always considered a part of the yards, about 35,000 people. In 1899 the total receipts of animals were about 2,500,000 cattle, 140,000 calves, 9,200,000 hogs, 3,700,000 sheep, and 120,000 horses (for this yard is also the greatest horse market in the world). To bring this stock to market required nearly 300,000 cars, or a train over 300 miles long. The Stock Yards Company controls all manner of industries within its grounds, from water plants and fire departments to restaurants and boot-blacking stands.

When a load of stock is run in on the side track, the cattle or hogs are run into chutes by the company and locked up until the man to whom they are consigned sends for them. Then a "key-man" opens the chute and gives the animals into the care of the consignee. This man may be



TALKING WITH A MEGAPHONE

THE MEGAPHONE IS USED ON THE OCEAN, ON BATTLE-FIELDS AND IN VARIOUS SITUATIONS WHERE THE HUMAN VOICE WITHOUT THE AID OF THIS INSTRUMENT WOULD NOT BE HEARD

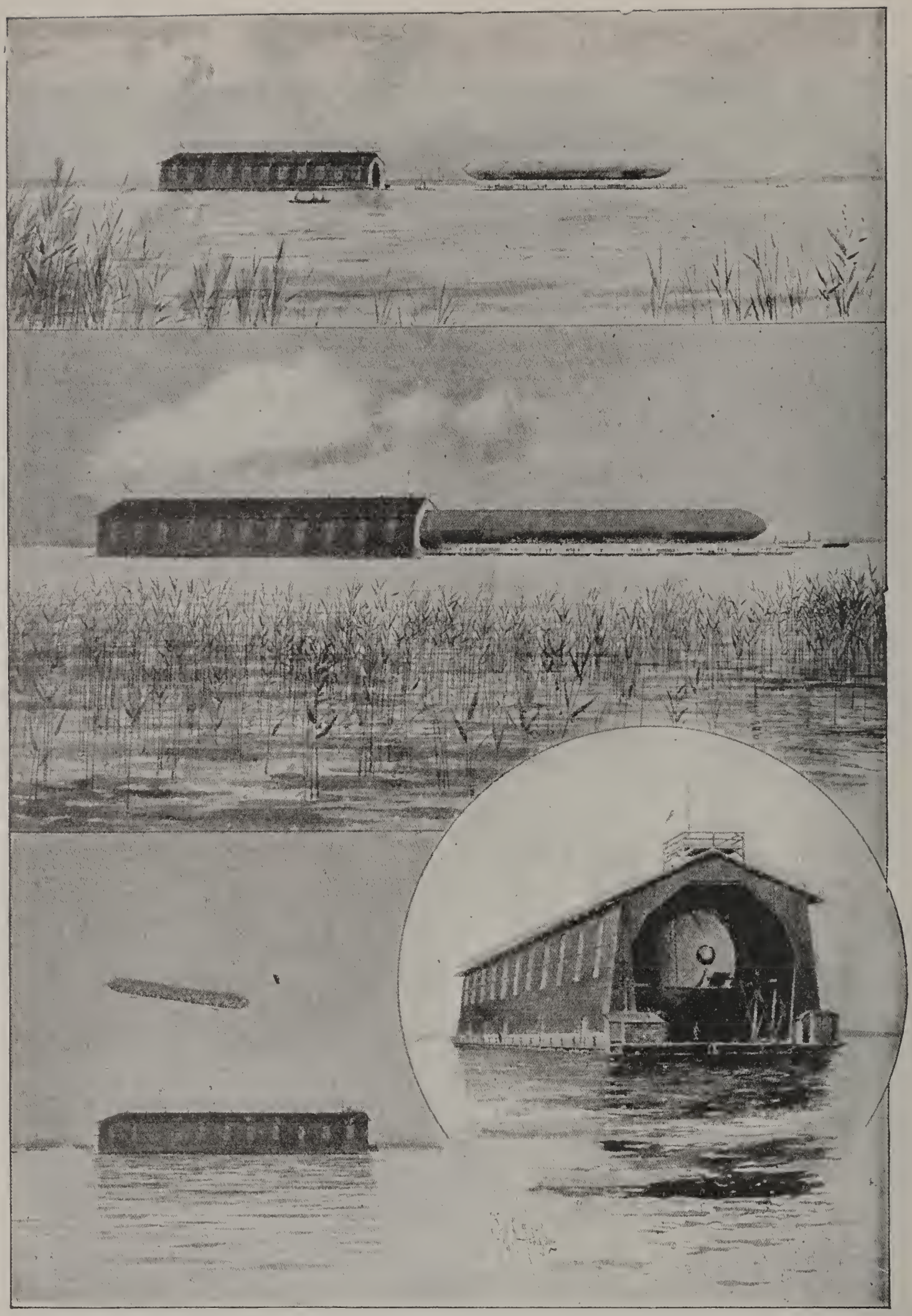


WEIGHING GOLD IN THE KLONDIKE—SCENE IN THE BANK OF BRITISH NORTH AMERICA



SALUTE BY INDIANS TO A DEAD CHIEF

IT IS CUSTOMARY FOR INDIANS TO PAY RESPECT TO THE MEMORY OF A CHIEF WHO HAS GONE TO THE HAPPY HUNTING-GROUNDS BY A FEW WORDS OF A WAR-SONG, A WARWHOOP OR HOLDING UP THEIR PIPES TO THE DEAD BODY



AERIAL NAVIGATION—ZEPPELIN'S AIR-SHIP

1. AIRSHIP CONVEYED TO THE SHED BY A TUG. 2. THE AIRSHIP BEING TAKEN FROM THE SHED. 3. THE AIR-SHIP STARTING. 4. THE AIR-SHIP IN ITS SHED.

a packer or a commission man. From the chutes the animals are driven to pens that custom has given to each particular firm. Here they are inspected and sold. As they go to the scales and are weighed government inspectors throw out poor stock, while a public shrinker docks some animals that are not in the best condition from forty to eighty pounds. Condemned animals have a tag fastened in their ears. Three main sections in the yards are laid off for cattle, sheep, and hogs. The cattle pens are large, roomy places which will hold several car-loads, and are brick paved. The pens for hogs are double-decked, that is, like a two-story house, one pen over the other. The sheep are all taken to a roofed place called the "sheep-house."

The Pens

are divided into blocks and divisions just like a township, to facilitate in locating stock. The yards cover no less than 475 acres, 320 of which are covered with plank flooring. There are 13,000 pens, 8,500 of which are covered for housing hogs and sheep. The divisions and blocks lay out the place with twenty-five miles of streets, while there are thirty-eight miles of water troughs for watering stock, ninety miles of water pipe and fifteen miles of sewers Six artesian wells furnish the water supply, and in summer time the tanks and reservoirs hold water for emergency to the amount of 8,000,000 gallons. Owners are put to no trouble in the handling of stock, for all kinds of feed are delivered to the pens by the company, and the watering, feeding and yarding is all conducted under its care at reasonable cost. Two hundred commission firms located at this market make competition acute. A thorough system of inspection for disease by government officials makes it almost impossible for unhealthy stock to be sold. And when one considers that in one year $230,000,000 worth of stock is yarded by the company and it seldom occurs that a single head is lost, one can possibly understand the magnitude of this great buying and selling center.



KILLING "KOSHER" CATTLE.
For Jewish customers meat must be dressed with especial religious rites.

But aside from the simple handling of

stock by commission men and speculators, the Stock Yards are noted for the latest and fastest methods for killing, packing and shipping to all points of the globe the meat supply of all humanity. The largest packers at Chicago include Armour & Co., Swift & Co., Nelson Morris & Co., Libby, McNeil & Libby, and the Cudahys. All these firms are capitalized in the millions, and nearly all have branch yards and packing houses at Kansas City, Omaha, St. Louis, and several other points, while they are represented by salesmen and markets all over the world. To give an idea of the immensity of one of these concerns the following figures are given: One company in 1898 purchased live stock to the aggregate of 1,437,844 cattle, 2,658,951 sheep, and 3,928,659 hogs. Sales the same year amounted to $150,000,000, and the total number of cars needed to carry the meats was 107,684. From this number of live stock there were made 196,244,585 pounds of lard, 6,472,857 pounds of wool, 3,88[illegible]983 pounds of neatsfoot oil, 5,487,540 pounds of glue, 8,116,338 pounds of butterine, 26,009,453 pounds of tallow and grease, 61,635,047 pounds of oil, 90,079,748 pounds of hides, and 86,226,586 pounds of fertilizer. This same company's plant at Chicago extends over forty acres of land, of which thirty-eight acres are covered by buildings, the latter having floor space to the area of sixty-seven acres. Twenty-five engines with eighty-one boilers and 12 dynamos supply the plant with power and light, while seven refrigerating machines with 125 miles of pipe have a capacity of cooling 1,400 tons of meat daily. The storage and cooling rooms have a capacity of 5,000 cattle, 7,500 sheep, and 12,000 hogs. Six thousand and eighty-five employés that carry on this gigantic enterprise necessitate a weekly pay roll of $70,000.



IN THE HOG "STICKING-PEN."
Showing a sticker in the act of killing.

Numerous methods are used for

Killing

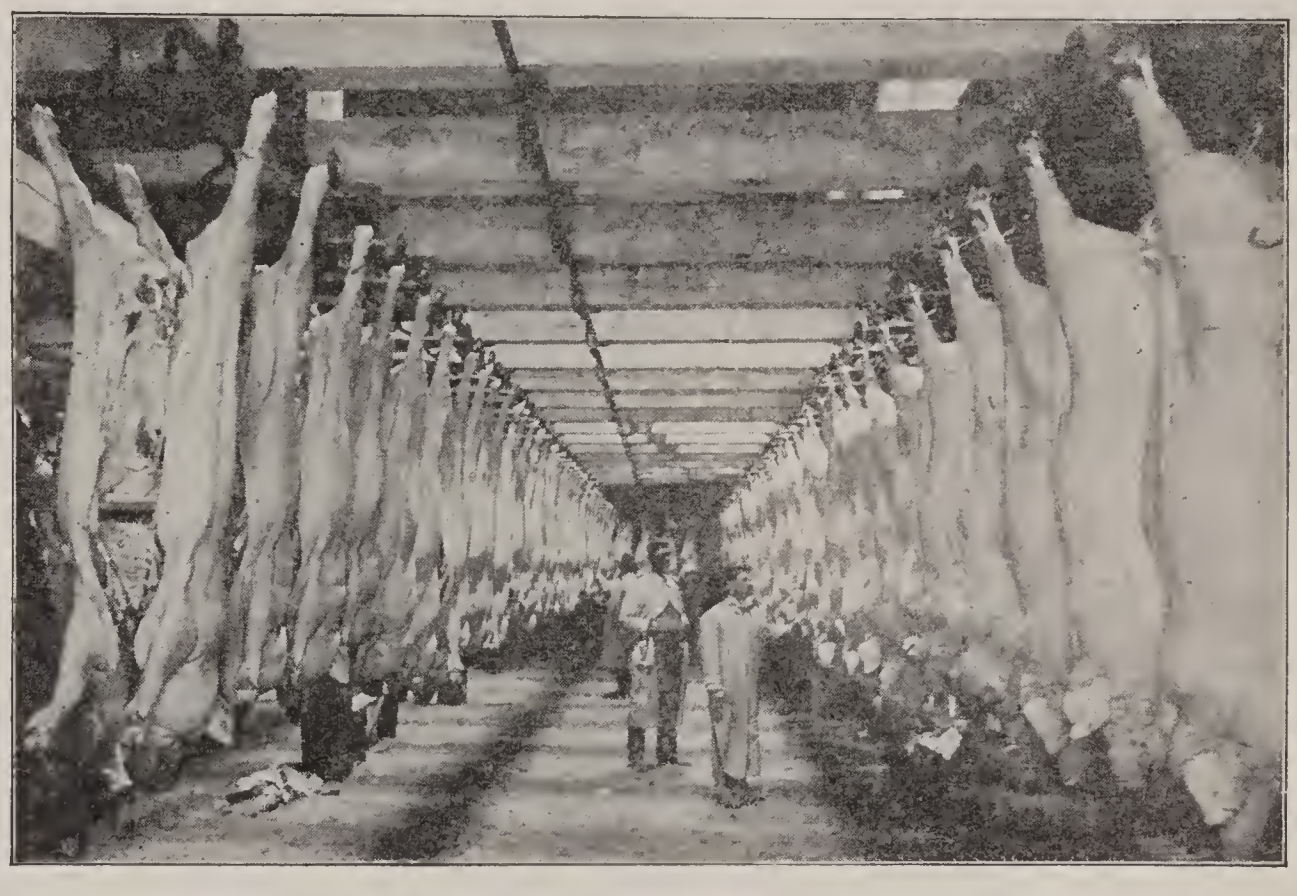
and preparing the stock for consumption. The cattle are driven from the buying pens over long runways to pens near the slaughter houses. From these they are run one by one into pens within the house, each just large enough for one animal. Platforms run along the side of these pens and level with the top. Along these platforms walk men with small sledge-hammers, and when just above a steer, one of them will suddenly swing the ham-

mer with stunning force upon the head of the animal just between the horns. The animal drops to the floor, and then a gate is swung up, the floor turns upward on one side upon a pivot, and the animal rolls out, only to be quickly jerked to the ceiling by a chain fastened about one hoof. At once the throat is cut, and the head removed; the animal is drained of blood, and then in quick stages the hide, hoofs, shanks and inwards are removed, and sorted to their various departments. The "splitter" comes along and splits the animal down the backbone. All this time the carcass has been traveling upon an endless trolley; and now, after it has been washed and cooled, it is ready to be stored in the great refrigerating rooms, whence it comes later wrapped in cloth and is shipped away in specially prepared refrigerator cars all over the world. For Jewish customers a special killing is necessary because of the tenets of their religion that will not allow them to eat meat other than that killed by an ordained rabbi, or which has ever had a broken limb. Instead of using the hammer for stunning, the animal is first tied by the feet, then raised in the air by the one hind foot. A killer appointed by a rabbi comes along murmuring a prayer, and with a quick slash cuts the animal's throat. This process is called

Killing "Kosher,"

and is very rapid, in one plant 250 being killed and dressed an hour.

With sheep the process is similar to other killings, only the sheep are suspended two by two on hooks that run along a continuous trolley line. As each set passes a certain station a certain part of the process is completed. The killer sticks the knife in their throats at the rate of twenty a minute; then the animal moves along to each specialist until the carcass appears at the end of the trolley held apart with wooden sticks, ready for the chilling room. With this branch of



UNITED STATES INSPECTORS MARKING HOGS TO BE SHIPPED.

slaughtering as with others, the Jewish method necessitates a special slayer, who places the edge of the knife between his lips and mutters a prayer before every death stroke.

With

Hogs

an odd device like a great drum, with six hooks at intervals on each side, revolves by machinery. Each hook is so arranged with a little wheel that, when a hog is fastened to one as the drum revolves, the hog is jerked with it till it reaches its highest point, when the little wheel slips

on to the rail of a trolley and the hog is quickly run down to the killer. This man makes the quickest killing of any, numbering about twenty-five strokes per minute, while 550 wholly dressed hogs are turned out from one plant each hour. From the killer the hogs go to the "gutter," and then to the scalding trough, where in boiling hot water and with the aid of a scraping machine most of their hair is removed. Next in a cooler bath the last vestige of hair is scraped away by hand. From here the carcass goes through the general process of cutting up, only with hogs the cutting is in smaller pieces. The leaf lard is sent to markets or to the refinery; the sides are pressed into shape for bacons by hydraulic presses, while odd bits and cuttings are sliced off here and there and shot through tin chutes hundreds of feet long to other parts of the building, where they are packed in boxes ready for shipment.

The process of killing must for facility be divided so that each man does but one part of the work; thus, one man kills, one man "guts," another removes the hide, another chops off the hocks, while still others split and divide the carcass into marketable shape. The animal is always yet warm ere the process is complete, and in from three to five minutes after the live animal is driven into the pen, the meat is ready for cooling. It is remarkable that not an ounce of a slaughtered animal goes to waste. Every part that cannot be used directly for food, wool, leather or oil goes to the "tank" and is refined into glue.



CHICKEN KILLING.

With a corps of eighty men, 10,000 chickens, 8,000 ducks or 6,000 turkeys are killed and dressed by the above illustrated process every day. Each operator has his certain work to do; one man fastens the fowl's legs to the hooks on the endless chain, and also hangs a little can to its neck just below the bill. The chain moves on, a man sticks an awl through the neck of the fowl, and the blood drips out into the can, whence it is sent to the "tank" for fertilizer. Then as the chain goes on each man plucks his part of the feathers till all is done.

Great Governments of the World.

HOW THE NATIONS OF TO-DAY GOVERN THEIR PEOPLE.

GOVERNMENT has existed since the birth of man. Opinions differ with people and nations as to the goal to be reached by this or that method, but the intelligent person watches with interest the growth in any form of the great science of politics and government. The entire human family has undergone, or is still undergoing, vital changes of government and mutual relationship. A glance at the various governments in operation throughout the world at the present time will reveal the important fact that few, if any, of the methods familiar in the pages of history are absent from the list. We still have the savage communities, which involve almost an obliteration of the family relation rather than the existence of one large family; there are the nomadic hordes and camp-followers, grazing their herds on the edges of the desert at one time, and threatening to overthrow the world at another. Some countries still think the individual exists for the benefit of the government rather than the government for the governed. Let us glance at some of the larger nations with their most improved and enlightened methods of government, as well as their errors.

FRANCE.

In France, as much possibly as in any other great government, we have the extremes democracy and monarchy combined. When the old monarchy went to pieces under Louis XVI., the masses were afraid to trust any of the aristocracy with the reins of government, and, accordingly, boards were appointed to manage the different departments. When Napoleon assumed control, however, it was an easy matter to place trusty tools or single officers in charge. After him came changes of republics and empires until to-day, under the third republic, we have a system of government combining the features gained from the advanced republican thinkers of France (the country most advanced in theoretical republicanism) with those of a strongly centralized military rule. One cannot study the government of this powerful republic without taking into consideration the enormous power wielded by the army, and the almost implicit confidence placed by the common people in that body.

A national assembly, elected to treat with Germany after the Franco-Prussian War in 1871, found itself in control of the government, and while the members were largely monarchists, the general tendency

of France as a whole was toward the republican form of government, therefore the assembly dared do nothing but draw up a republican constitution. To be sure, the constitution was rather meager, and tended strongly towards the monarchical, and it was not submitted to the people for approval, nor is such now necessary. We have, therefore, these two tendencies of monarchy and republicanism struggling for supremacy.

The divisions of France for electoral and administrative purposes are eighty-six departments, which are divided into smaller districts,—362 in all,—which are in turn divided into still smaller cantons, 2,899 in number, while the smallest subdivision is the commune, of which France has 36,170. Three sides of government exist, the legislative, executive and judicial, though all are so centralized that a comparison to the government of the United States would be entirely out of place.

The Legislative Department

is divided into a chamber of deputies and a senate, members of the first to the number of 584 being elected for four years, while those of the senate are elected for nine years, one-third retiring every three years. Each male citizen of twenty-one years who has resided six months in a commune, and who is not disqualified, may vote. Deputies must be citizens twenty-five years old, and receive $1,800 a year and free transportation on all railways. As a rule they are men of ordinary caliber, being retired business men, doctors and farmers. Senators are forty years old or more, and average sixty-three years, with salary the same as the deputies. The deputies are elected directly from the districts, though some of these are so large that two or more constituencies are made from them. Election day is set by government and not by law, and always comes on Sunday. If no candidate receives an absolute majority of all the votes cast, and at least one-fourth of the registered voters in his constituency, another election is held in two weeks, in which a simple plurality elects, and if a tie occurs, the oldest man is chosen. Senators are chosen from departments by electoral colleges (bodies of men elected for the purpose) composed of three classes: first, of delegates chosen from the municipal councils of the different Communes in the Department; second, of senators and Deputies of the Department; third, of members of the council general of the Department, and of the members of the different councils in the Districts of the Department. The senators are not often men of national reputation, but retired professional men from the country towns. The work of the senate is not much beyond that of deciding with the president when the chamber of deputies shall be dissolved, and that of sitting as high court for impeachments and trials of persons who threaten the existence of the state. In general it is a body inferior to the chamber.

The President of France

is elected by a majority of the chamber and senate sitting in joint session, and no member of the royal family may hold the office. The president's salary is $125,000 yearly, with a great retinue of servants and the free use of the palace (Palais d'Elysees) in Paris. He has no veto on legislation, though he may return a bill for a second vote. He may adjourn the houses, though only for a month; may close a session over five months old, and with the consent of the senate may dissolve the chamber of deputies. The president has for his advisers a cabinet of eleven ministers of the different portfolios of finance, war, marine and the colonies, foreign affairs, etc., whose salaries are each $12,000 a year. These ministers are

chosen by the president with a view to their influence in the respective house of which they may be members, and generally with the advice of the presidents of the two houses. They really frame the legislation of the administration, and must sanction the acts of the president ere they are effective. They speak in both houses, whether they are members or not, but when they cannot control the bodies in legislation they are forced to resign, and a new cabinet is chosen. The smallest factional fight will defeat a cabinet, the average life of the cabinet being about eight or ten months. And yet the government is largely that of the cabinet rather than of the president, for the latter really has no very great powers, and is more a luxurious figurehead than anything else.

Legislative Methods

begin with a choice of eleven bureaus in the chamber by lot at the start of each annual session, while nine are selected in the same manner by the senate. These bureaus choose from their numbers a monthly committee on parliamentary initiative, to which all bills are first referred, when presented, to decide if they are worthy of consideration. This committee practically passes all serious bills, and after printing them refers them to their respective bureaus. The bureau selects a sub-committee for study of the bill, though this is generally on party lines. After the bill has been amended to suit the committee, it is presented before the chamber by a commissioner, who does not speak from his seat, but from a "tribune" above and behind the chair of the president of the house. The speaker (president of the chamber) has nothing of the great power wielded by the same officer of the United States, though he is elected by party rule. French parliamentary practice differs greatly from that of almost any other country, it being nothing uncommon for members to shout out their opinions of disapproval of the person speaking, and even the speaker will stoop to trivial criticisms of members and speeches.

Another body, the "council of state," a relic of the days of Napoleon, performs the function of advising the president and ministers on matters of public importance. The members are, in many cases, men of learning, and do considerable good in preparing rules for administration, though, as far as legislation is concerned, they are of little avail, for they are not generally consulted.

Since the cabinet is dependent upon the chamber for support, it must naturally deal out favors to the deputies. These are largely in the shape of offices for friends and political aids. Public opinion is largely felt in France, and to avoid censure of the press, it is a well-known fact that the great sums of money at the hands of the cabinet for secret service are largely spent in subsidizing the newspapers.

The System of Courts

starts with the usual local justices of the peace, ascending through courts of appeal to a final supreme court. The president of the republic appoints the judges, with the aid of the minister of justice, and with the exception of the justices of the peace the tenure of office is permanent. A special court also exists, composed of judicial officers and men of administrative training, whose duty it is to decide disputes arising over administrative questions or between officers of the administration and citizens. The methods of procedure in French courts are entirely different from those in America or England, and while there is not so much chance for a guilty criminal to avoid

sentence, at the same time, the system lacks the security of personal liberty. One judge in secret does the work of examining cases instead of a grand jury, and he may dismiss the case or commit it to trial at his own discretion. Many courts which sentence but for three or four years consist of three judges who act without a jury. A prisoner may be kept for days without communication with his friends, and if the judge so wills it, all the evil effects of the old "lettres de cachet" of the days of the Bastile can be reproduced. In the higher courts twelve jurors generally assist the judges and decide by a simple majority. In commercial cases there are special courts and councils made up of experts.

In Local Government

each district has a prefect, or sort of governor, appointed by the president for an indefinite term and responsible to the cabinet. A general council of the department, elected by general vote for six years, one from each canton, assists him. These carry on the general work of the department, such as management of schools, local courts, railroads, asylums and the poor. Likewise the district (arrondissement), the next smaller division, has a sub-prefect appointed by the prefect, responsible to him and really acting as his agent. A council, one member elected from each canton, has the work of dividing the taxes among the communes. The canton is simply a small election district and judicial district for justices of the peace, muster district for the army, etc. The commune (still smaller) is self-governing, and is the unit of all government. Each elects a municipal council according to its population, and this council elects its mayor. The mayor, however, when once elected, becomes the agent of the central government at Paris, and may be suspended or removed if so desired. By the system of appointments and removals from office the government can for a time be absolutely despotic in its decrees, though when this happens new elections shortly remove the real offenders. Thus we have really two extremes of government, yet the great centralized power is plainly shown for the good in the great roads, bridges, expositions, public improvements and educational institutions of France.

GERMANY.

After the ravages of Napoleon upon the German states, their rulers naturally sought a defensive alliance. Till after the war of 1866 Austria was the natural leader of the union, but at that time Prussia came forward and Austria was thrust out. Three forces set to work to bring about what is now the German Empire, namely: first, the necessity of union of the several states; second, the great Bismarck of victorious Prussia, wishing order more than freedom; and, third, the princes of the different states, desiring to perpetuate their thrones, and wishing a degree of states' rights.

History.

After the victories of the Prussian army against the French, the king of Prussia was elected the president of the union with the title of "emperor," and the first coronation—that of Emperor William—took place in the palace of Louis XVI. at Versailles, near Paris, which was still besieged, January 18, 1871.

Shortly afterward a diet was called and the new constitution was drawn up. This has not distinctly marked in it the three-sided form of government so familiar to Americans.

The Imperial Government

consists of the emperor and his administration, a federal council (or bundesrath)



BRIDGE ACROSS THE RIVER ARNO AT FLORENCE, ITALY



THE YUKON RIVER, ALASKA, BY MOONLIGHT. THIS WONDERFUL STREAM RISES IN BRITISH AMERICA, PASSES THROUGH ALASKA, AND EMPTIES INTO THE BERING SEA, NEAR ST. MICHAELS. IT IS 2000 MILES LONG



ARCH OF TRIUMPH, PARIS



COLOSSEUM, ROME

similar to our senate, and a diet (or reichstag) similar to our house of representatives. The latter is composed of 397 members elected by popular vote for five years. Any German twenty-five years old can vote or be a candidate. The members are not paid, but receive free transportation. Bills cannot be introduced in the diet without support of at least fifteen members, and when a bill concerns only a certain state, either in the federal council or in the diet, the whole house does not vote, but rather only that portion affected by the bill. The diet must be consulted on war, the senate on treaties, and neither house can adjourn for more than from day to day, the emperor having the right to fix the dates of adjournment. He is also empowered to dissolve the diet and order a new election within sixty days. The federal council is almost a counterpart of our senate, being composed of ambassadors from the different states of the union, selected by the head of the state, aided in a measure by the legislature. They vote according to the number from their respective states, and votes are cast in a lump by one spokesman for each state. The council is a perpetual body, and the emperor must convoke it upon the request of one-third of the members. The imperial chancellor presides over the council, and in case of a tie, his vote produces the necessary majority for legislation. The council must concur in the legislation of the diet before it becomes a law, and accepts or rejects treaties. In case a state of the union shall not obey commands, the council may enforce its edicts with arms. The council is also empowered by the constitution to execute laws whenever no other provision has been made by law, thus giving, it is said, the actual sovereignty of the empire to this body.

The Emperor

at first glance would be thought to have no more power than that of our president, but it must be remembered that the constitution makes the ruler of Prussia its emperor. The Prussian crown descends to the oldest male, hence a man is always in power. This allows customs to grow up, and privileges are granted the ruler that would never be the case if a president governed, or if the emperor came from a different state each time. Also the German people have a great respect for the glory and grandeur of the imperial throne; the emperor represents the empire in all its foreign affairs, appoints ambassadors without confirmation, and receives those of other courts. Besides this, he is almost absolute lord over an army of 500,000 thoroughly trained soldiers, always ready for the field. As king of the Prussians, he controls their seventeen delegates in the federal council, and it would mean almost revolution if he could not secure the other fourteen votes necessary for a majority. And then Prussia has absolute veto power on questions relating to the army, the navy, and the imperial taxes. This gives the emperor power enough to whip any faction into line.

Bills

are generally prepared by experts and submitted first to the council, and if passed here sent through the chancellor to the diet. Amendments of the constitution are not referred to the people, but are enacted by the council. If fourteen votes are cast against such a measure it cannot pass; hence, it can be seen that no group of smaller states can force on Prussia, with her seventeen votes, a distasteful amendment, and yet neither can Prussia so work against the smaller states that they cannot secure fourteen votes to quash measures harmful to them.

The Chancellor

is the emperor's right-hand man, appointed by him and removed at pleasure. He generally controls politics, is head of the Prussian delegation in the council, and presides over that body. All acts must be signed by him before they become law. Bismarck was the greatest of the chancellors.

Local laws of the different kingdoms of the empire govern mostly in the courts. There is the usual system of local, district and superior courts in the various kingdoms, the judges being appointed instead of elected. From the superior courts appeal is had to the imperial supreme court, which consists of eighteen judges who sit for life and are appointed by the emperor. The empire has a code of criminal law, another for commercial, and recently a civil code that governs the judiciary of all the kingdoms. The powers of the supreme court do not reach to declaring acts unconstitutional, for there is no distinction between constitution and statute. In fact, the judiciary of Germany is only a branch of her political administration.

The nature of the empire, while

Not Strictly Democratic,

is yet as much as can be expected of monarchical states, and very well fits the people it governs. It is no loose confederation, but a firm pact,—an "indissoluble union of indestructible states." Its laws take precedence over those of its states, and a revolting state would be brought to terms by arms. The taxing power is limited to customs and excises on salt, tobacco, beer, brandy, beet sugar and sirup. Pro rata contributions can be called for from the kingdoms to meet emergencies. The empire controls the coinage, railways and telegraph, though the states are allowed to operate mints, and to some extent own railways.

The main defect of this government is that it has no bill of rights in its constitution that guarantees to the individual certain rights against the encroachments of the government when in the hands of unscrupulous agents.

GREAT BRITAIN.

The government of Great Britain is that of a limited monarchy in name only, for, though the oldest member of the reigning family holds the crown and title, as well as the honors of a monarch, yet the power is so limited that were the ruler to attempt to coerce the representative branches of the government, revolution would result in dethronement. The government is that of a cabinet under constitutional control as worked out by a house of commons and house of lords, influenced to some extent by the King and to a great extent by public opinion. Unlike the constitution of the United States, that of England is unwritten, being a mass of customs of gradual growth which it has taken years to be brought out from public acts of the parliament against the reigning sovereign.

In Early Times

in England the power of the monarch was nearly absolute, but gradually, by hard fights, the people gained rights in representation in parliament, some monarchs were deposed, others executed, and still others judged insane or incompetent and regents were appointed. The house of commons deposed Charles I., appointed Cromwell president of the Commonwealth, and later called a monarch back to the throne. James II. attempted later to enforce edicts distasteful to parliament and was deposed, to be succeeded by William and Anne. Since these rulers a cabinet has always played an important part in English government. When

George I. came to the crown he did not understand English, and necessarily leaned a great deal upon his cabinet. Later, George III. tried to do away with his institution, but he eventually had to come around to its use again. Since that time

The Cabinet

has grown into a permanent branch of the government, though not mentioned legally as such, it being simply a growth by custom for convenience' sake.

This cabinet is of from fifteen to twenty of the chief ministers of the various departments or portfolios of the government. A state of affairs that brings about two political parties is necessary for such a form of government, for each party must strive for supremacy, and criticise the acts of the other. The ministers naturally have control of the parliament so as to influence the passage of important measures, or they are of no power and have to resign. When a great issue is at stake, the party that is defeated must of necessity resign the ministry and with it the cabinet positions, for without support of parliament a dead-lock would result. The alternative is had of dissolving the house of commons and appealing by elections to the spirit of the public. If members in sympathy with the measure at stake are returned to the house, the administration is vindicated and the bill is passed, for if the house of lords refuses to agree in the legislation, which by law is necessary, the house, with the queen, can create more new peers to take seats in the house of lords, and thus effect a passage. It is to be seen, therefore, that

The House of Commons

is the direct representative and servant of the public, that it is superior in power to the lords when really supported by the people at large, and that the reigning sovereign must to a great measure coincide with the wishes of the government of the house of commons in order to avoid a revolution. If, then, the commons is so powerful and the direct agent of the people, what is the office of the cabinet, and why is the government at all a monarchy? First, the cabinet is not recognized as such by law. As said before, it was of gradual growth, a secret body of advisers to the sovereign. The party having control of the parliament, and hence most directly representing the people, is the one that the sovereign must consult in order to have any legislation passed. Therefore, when one ministry and cabinet has resigned through lack of support in parliament, the queen calls to her aid the leaders of the victorious party in both houses, appoints them to the offices in the ministry (the privy council), and from the officers of the ministry selects the cabinet that is to originate and influence legislation and administrative acts. Having no standing according to law, the cabinet may act not as the cabinet but as the privy council. The head of the cabinet is the premier, but neither is he recognized by law; he is generally the minister of foreign affairs.

As to the second point,

The Government is Monarchical

because the queen, though not having veto power, yet exerts a powerful check on the cabinet, lords and commons, and though the people are largely democratic, yet they have a great respect for their sovereign, and would not return to parliament members that would willfully set at naught her rule.

The method of administration and legislation, then, is that the cabinet of leaders of a certain party, backed by an influential force in the commons and lords, in secret session discusses and

frames plans of action. The advice and consent of the sovereign is gained, and the measure sent through both houses of parliament. If the houses concur, it is legal; if they disagree, the cabinet (as privy council) and queen may dissolve the commons and trust to an election to vindicate their ideas; or the cabinet may resign their positions in the ministry, whereupon a new ministry and cabinet is formed from leaders of the victorious party. Altogether, the system of checks and balances is admirable, the main feature being that though the queen can do no wrong, her ministers, as guided by her, can, and they are directly responsible for bad management, being forced to resign at the lack of public approval.

Since the

Constitution is Not Written

the courts do not sit upon the constitutionality of an act; the parliament is all powerful, and any legislation passed by it is presumably constitutional. Thus, if the judiciary, which is entirely separate from the legislative and executive branches, though appointive in some degree, should judge laws contrary to the opinions and wishes of parliament, acts would be passed that would nullify the old laws. The judiciary holds office for life, and cannot be removed except for cause. This gives a great degree of liberty to their acts, and tends toward justice in the main. The

House of Lords

has power almost collateral with that of the house in making legislation, except that it cannot introduce or amend money bills. The privy council, which is the legal body of the ministers in session, does the official negotiating with the queen and signs acts. Altogether, there are five sources of influence that bring about English government: First, the queen legally and formally appoints; second, the cabinet cannot continue to exist unless it has the support of a majority of parliament—thus the commons is said to choose the cabinet; third, when a new house is elected, the voters determine who shall be next prime minister, for the leader of each particular party is in mind when the ballot for members is cast; fourth, parties must exist to keep the system of cabinet up—that is, one party must always be ready to take the place of the one in power, thus making all acts open in the light of publicity; and, lastly, the man himself must develop into a leader in order to give a possibility for cabinet rule over the sovereign and lords.

RUSSIA.

Autocracy, or government imposed upon a people rather than created by them, is the principle upon which Russia is ruled. And yet in the home life of the Russian villagers democracy is pre-eminent. Thus the worst and the best form of governments occur in the same land, at opposite ends. The land of Russia is one-seventh of that of the whole globe, covers the cold sides of both Europe and Asia, and is inhabited by about 130,000,000 people. Three-fourths of this nation are people of the Slavic race,—people who for centuries have threatened the southern countries of Europe, and who, it is feared, will one day dominate the earth. They are admirably adapted to colonizing, and when in their early history robber chiefs arose who oppressed them, they simply moved to another quarter of their country where, in their "mir" or village, they could have some degree of freedom in the ownership of land. They did not dread slavery, but while being owned bodily, they still persevered in the customs of the "mir."

History.

When all the rest of Europe was being freed from the feudal system by the uprising of commoners, Russian nobles were just beginning to see the richness of the prize that lay before them in the shape of innocent villagers who knew not the terrors of robbery or slavery. At once the poorer classes were forced to carry out the will of the noble; law was unknown as the offspring of the people, and commands and edicts took its place.

Peter the Great,

who died in 1725, was the power that first began to bring order out of chaos, and the autocracy that he organized has remained for almost two hundred years to the present time. A great part of his work lay through the church. Russians had long been of the Greek orthodox church. A patriarch existed and the church owned its lands. Peter at once dispensed with the patriarch, confiscated the lands, and appointed a

Holy Synod

to do the bidding of the czar in matters ecclesiastical. Since the church is thus under the direct will of the czar, it must follow that any belief not to his way of thinking must be persecuted and perish. High-mindedness must needs soon dwindle, and instead of exposition of religion and teachings for the goodness of the belief, there is in reality nothing but vast ceremonials and endless doings. Thus, through the church, the czar wields an enormous influence over the minds and souls of the common people.

Three Agents.

Besides the holy synod, the czar has three other methods of executing his will: a committee of ministers, a council of state, and a senate. With these divisions one would suppose some division would be made of legislative, executive, and judicial duties, but such is not the case. That would be an approach to democracy, and we are here dealing with autocracy. All these bodies exert the functions of all branches of government, though each has its particular duties. However, the executive, instead of having a check put upon him by the people or any other branch of the government, is absolute; he issues orders instead of laws. Thus there is no legislative branch, the usual bodies simply aiding in suggestions for the executive and in seeing that they are properly issued. Neither is there such a thing as a branch of justice, for since there are no laws, there must needs be no interpretation of them; simply the enforcement of the commands of the executive. In short, the czar wills, the czar sees that his will is obeyed, and the czar punishes arbitrarily any disobedience.

For convenience' sake there are

Twelve Departments,

such as state, navy, justice, foreign affairs, and the like, and the heads of each, appointed by the czar, form the committee of ministers. Their duties are to aid in conducting the affairs of administration, and issuing explanations of the so-called laws. They may not resign without the consent of the czar, for then he would not be having implicit obedience. The council of state consists of some sixty members appointed by the czar, of which twelve are the ministers of the various bureaus. The duties of the council are principally those of consultation and information. Reports of the departments are read here and discussed, and special commissioners appointed by the czar look into the details of recommendations of the ministers. The council also considers the annual budget, or expense account.

The Senate

is the body through which the so-called laws are patched up in shape to dupe the people. It is composed of high dignitaries, also appointed by the czar, and these men have in charge the putting into effect of all commands. Ministers or governors of provinces are also here called to account for their conduct. The senate is regarded as the last court of resort in the feeble judicial system, though the council of state may review its acts.

Thus, there are four main agencies for the execution of the will of the imperious czar: the holy synod, for church matters; and for matters of state, through twelve departments or bureaus and the committee of ministers, the council of state, and the senate. All sorts of work are done in all bodies, and the sole object aimed at is the union of every phase of government into the single person of the czar.

Yet, while this autocratic method is pursued with cruelness over the great needs of the state, in the family life democracy is triumphant. Entire freedom of will is expressed in the

Government of the Town Meetings

by the heads of families, custom having gone so far that decisions must be unanimous to be effective. The "mir," or town, is all-powerful in all matters that pertain directly to its domestic life; its officers are responsible to the people at large, and it is no branch of the rule of the czar. All the czar wishes is obedience to laws, especially in the matters of taxation. Here the "mir" is willing to submit; the people are simply victims of the higher government, but complain little if let alone in their home life and ownership of land.

It is not to be wondered at that such a government by one powerful and possibly unscrupulous man should cause uprisings and plots. In fact, the government uses such methods, and the people copy after them. It is said that assassination is a frequent method of meting out so-called justice to the czar's subjects. After a time such a rule must needs dwarf the sensibilities of the people, and then worse punishments must be prescribed to arouse dread.

Flogging

and exile to the mines in Siberia are of daily occurrence. Without warning, the government lays hold on those who have broken no law, and subjects them to the severest penalties. What wonder, then, if the government that uses the sword in the place of law must in the law of nature sometime perish by the sword?

THE UNITED STATES OF AMERICA.

It is a common and erroneous saying that the constitution of the United States is the most marvelous instrument ever struck off by the brain of man. This would lead people to think that our forefathers simply sat down to the task of writing a constitution, and produced a paper at first thought that has since proved almost perfect. Such was not the case. For generations before, both the colonists in America and their British cousins across the water had been fighting the domineering power of the English crown, and as a result many concessions were made to the

Representatives of the People.

Though we were oppressed by governors not our own, and by foreign-made laws, yet we had in every colony some form of democratic government as expressed in the councils and assemblies. In most cases there had been grants or charters, given by the sovereign, enumerating certain privileges. These were in reality little constitutions. All the colonies

were in the habit of sending complaints to England, sometimes even rebelling if the governors did not acknowledge the proper powers of the people. What wonder, then, that upon throwing off the English yoke the different colonies should at once frame constitutions democratic in nature, somewhat improving upon their old forms, and later that the colonies upon uniting into the common union should combine all their various forms into one instrument? Many clauses in

Our Present Constitution

were deemed decidedly undemocratic by some of the colonies, and vice versa. Thus the great central system of our government is built about an instrument that was in every sense the outcome of simple experience, and one of compromises and concessions.

In 1787 a body of men framed this constitution, and referred it to the various colonies for ratification. The instrument stipulated that upon the adoption by nine colonies it was to be effective, and was to be permanent. In 1788 nine colonies had signed, and in 1789 George Washington was installed as the first president, with the capital at New York. The government thus laid down in writing, and which by common consent is supreme, consists of three main departments: legislative, executive, and judicial. The first comprises two representative bodies: the senate, or upper house, consisting of two members from each state elected for six years each and so divided that one-third of the house is new every two years; and the house of representatives, consisting of members from each state in number according to the population, and each elected for two years. The senators are chosen generally by the legislatures of the states, and if a vacancy occurs during vacation, the governor of the state temporarily fills the vacancy. The representatives are elected directly by the people of the congressional districts of each state. These two houses are almost co-ordinate in their powers, though only the representatives can introduce money bills, and only the senate can ratify treaties with the president, and agree to appointments made by him.

L. of C.

The President of the United States

is the main executive, elected by an electoral college, and serves for four years, with the privilege of re-election. The electoral college consists of members chosen from each state, equaling in number the representatives and senators of that state. These electors are chosen at large by the people of the state, and at the capital of their state on a day appointed by law they cast their votes for president and vice-president. The votes thus cast are forwarded to Washington, where they are all counted together and the decision made as to the man elected. All the electors of one party in any state may be elected by a bare majority, especially if election districts are so marked out as to favor that party. Thus, while the popular vote of the whole country might favor a president of one party, the system of electors may result in placing a man in the chair who has the less number of votes of the people behind him, as when Harrison was elected over Cleveland in 1889. As far as law is concerned, the elector is not bound to vote for any particular candidate, but custom has arisen by which they pledge their votes for the leader of their respective parties.

The Duties of the President

are to see that the laws of the land are duly carried out, to send a message to each congress suggesting needed legislation, and to sign or reject bills for legisla-

tion. He has the veto power, but the two houses of congress may pass a bill over his veto by a two-thirds vote. He is commander-in-chief of the land and naval forces of the United States, is the official representative of this country in dealings with foreign powers, and is the general adviser for the welfare of the government. Assisting, though not called for by the constitution, are a number of officers who head the different departments of state, navy, war, interior, treasury, etc., and who together form his cabinet. With these men, who, by the way, are selected by him with the consent of the senate from the greatest men in the country, he consults on matters of administration. They are directly responsible to him for their acts, and censure would lead to resignation, though not necessarily without the demand of the senate. Each of the department heads sees that the work in his particular province is carried on; for instance, the postmaster-general controls in a great measure the post-offices all over the country.

When

Legislation

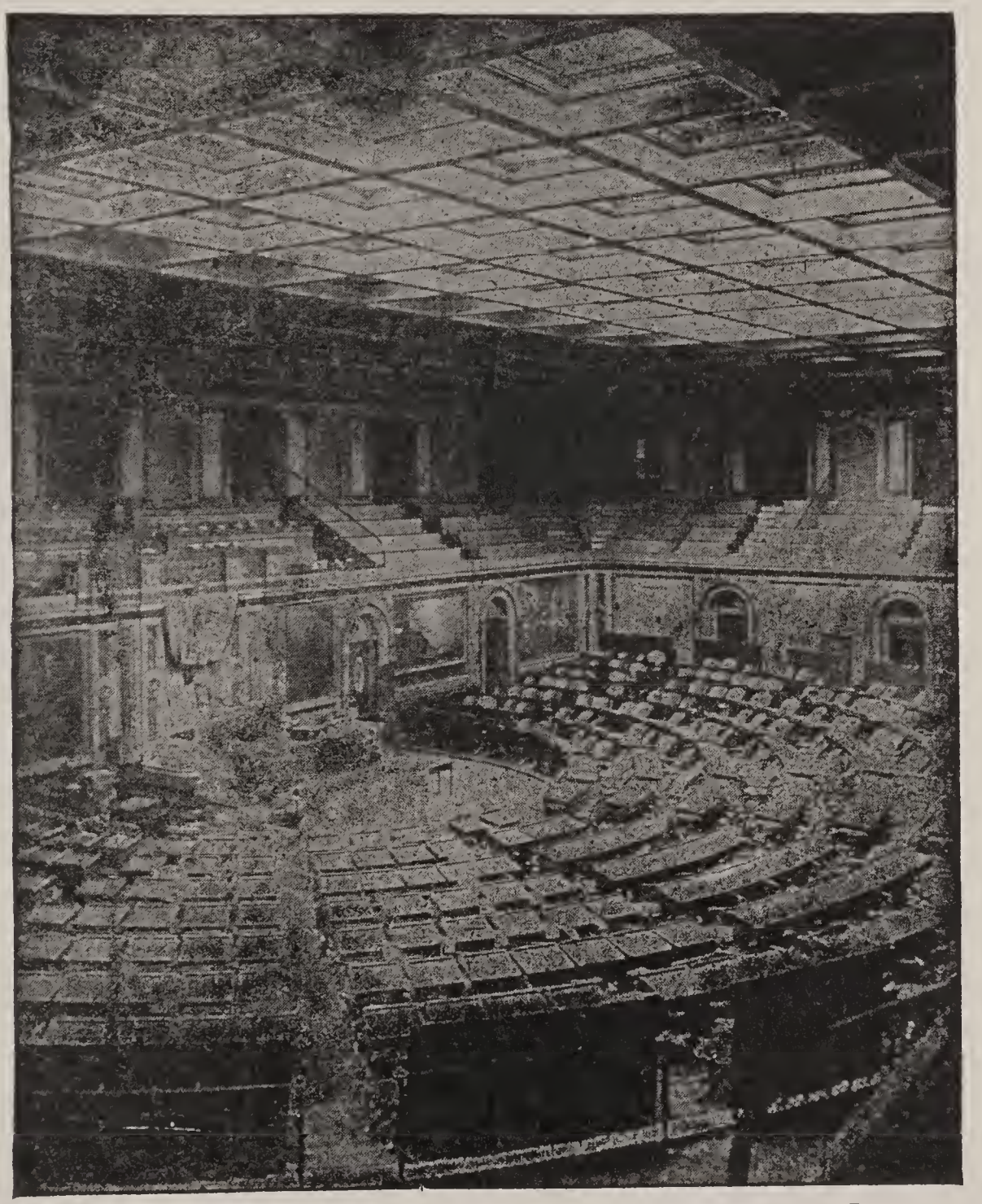
is proposed in one of the houses it is sent over to the other for confirmation. Here it is either refused or passed. In the latter case it goes to the president for his approval. If he signs it, it is at once a law; or if he allows it to remain unsigned ten days there is the same effect. As before said, he has the veto power, but he cannot block legislation that has the support of two-thirds of congress. The senate is the more conservative of the two houses, for it represents not the people directly, but rather the individual states of the Union. Here are brought to naught many of the bills from the house of representatives that are considered too radical. The legislation in the house of representatives is carried on largely by committees. A speaker elected by the house appoints a number of standing committees for various subjects to be considered. When a bill is presented, it is at once referred to a committee, which refers it to a sub-committee. If the bill is in favor with the party in power the committee reports favorably, and a vote is cast. But if otherwise, the committee never lets it see the light of day again. Thus it may be seen what a power resides in the speaker.

The Judicial Department

consists of a supreme court and various lower courts, entirely independent of the other two departments, though generally somewhat in sympathy with them. The federal courts, which are courts of the United States as a whole, in distinction from those of state power, pertain only to the laws of congress and the constitution, with the exception of the supreme court, which is the court of last resort for any legal question, be it of state or federal law. To understand just the distinction between the federal and state powers one must know that in their local governments the states are absolutely supreme, that is, of course, where they do not come into contact or conflict with the powers given by the constitution to the federal government. The federal authorities govern only such questions as interest the whole union of states. The minor matters of the states, such as police, civil and criminal laws, schools, etc., are in the domain of the states alone. These have assemblies consisting of two houses elected by the people, and a governor, for the enactment of state laws and the execution thereof. Whenever the federal government attempts to encroach upon the rights of the states, they at once appeal to the constitution, which is the supreme law of the land. The judiciary decides

what is the proper construction of the constitution, and declares the law valid or void as the case may be. Thus we have a system of checks and balances as good as almost any government. The president cannot act without the aid of the houses, the houses cannot enact legislation, unless by great majorities, without the consent of the president, and after the law is enacted, if it is questioned, the judiciary must also be in accord with the other branches of the government before the law is legal.

The tendency all the while is for the **Supreme Court** to uphold the acts of congress and the president, for it considers that the congressmen are serious in their intents, and not merely passing laws to hold their positions. This leads the federal government more and more to control the states, and tends toward a centralized government. But if the people do not like this method, they at once resort to the ballot, a new president soon takes the chair, and new senators and representatives govern more in accord with the sentiments of their constituents.



HOUSE OF REPRESENTATIVES, WASHINGTON, D. C.

Colonial Government of the United States.

THE president is giving careful attention to the selection of civil governors for Puerto Rico, Cuba and the Philippines. As commander-in-chief of the army it is within his authority to designate civil governors to act under the direction of the secretary of war.

In administration circles it is not expected that congress will take hasty action concerning Cuba, Puerto Rico or the Philippines. Until congress relieves him the president will remain in supreme control of affairs in the islands, and he is proceeding under the conviction that the welfare of the people will be in his charge at least during the remainder of his present term.

PUERTO RICO.

The problem of civil government in the islands yielded or ceded by Spain presents itself in the simplest form in the case of Puerto Rico. That island is fully and without question under the sovereignty of the United States. It came to us not only by legal right, but with the cheerful and unanimous desire of its people, who are peaceful and loyal, and eager for the benefits to be derived from the application of American ideas of government.

In determining the question as to the form of government and the participation of the people of the island therein, the most important fact to be considered is that the people have not yet been educated in the art of self-government or any really honest government. The difficulty does not consist merely of a lack of familiarity with the methods and processes of government; it lies deeper than that, in the fact that the Puerto Ricans, as a people, have never learned the fundamental and essential lesson of obedience to the decision of the majority. In the experiments which have already been tried in municipal elections and toward government by municipal boards, the minority which is voted down almost invariably refuses to participate further in the business of government.

The attitude of the defeated party is precisely that which causes the continual revolutions in the government of other West Indian islands and the Central American states in the same latitude. It would be of no use to present to the people of Puerto Rico now a written constitution or frame of laws, however perfect, and tell them to live under it. They would inevitably fall unless they had a course of tuition under a strong and guiding hand. With that tuition for a time their natural capacity will, it is hoped, make them a self-governing people.

Plan of Government.

Some such provision should be made for future government as the following:

That we should first declare definitely, by statute, what general laws of the United States are to be extended to the Puerto Ricans, such as, for instance, the postal laws, the banking laws, the customs, navigation and internal-revenue laws with such modifications as may be deemed advisable, the laws against counterfeiting, the anti-trust laws, etc., and provide for federal officers to execute these laws just as they are executed in the various states and territories of the Union. That there should be a provision for a federal judiciary in the island, with the same kind of jurisdiction which is exercised by the circuit and district courts of the United States, and that jurisdiction to review their determinations should be vested in the Supreme Court of the United States, or in a designated circuit court of appeals and the Supreme Court of the United States. That there should be a form of local insular government provided which shall have complete control over the rights, property and obligations of the people of the island, substantially covering the field covered by the government of our respective states, and subject to limitations prescribed by congress of the same character as the constitutional limitations generally imposed upon our state legislatures.

Framework of the Plan.

The framework of this government should be substantially as follows: A governor, to be appointed by the president of the United States, with the advice and consent of the senate; the chief officers of state customary under our system, such as secretary of state, attorney-general, treasurer, auditor or comptroller, superintendent of public works, and superintendent of education, to be appointed in like manner, and a legislative council, to be composed of the chief officers of state and a minority selected from the people of the island by the president. That all acts of the council should be subject to the veto power of the governor and to be passed over the veto by a two-thirds vote, and no law should take effect until it has remained without disapproval for thirty days after presentation to congress, or to the president of the United States if passed when congress in not in session. That there should be a supreme court of the island, composed of judges appointed by the president with the advice and consent of the senate, and having appellate jurisdiction only; trial courts in separate districts, having general original jurisdiction, with judges and officers to be appointed by the governor, and a petty court in each municipality; that the several municipalities now existing in the island, with such consolidations and alterations of boundaries as the council shall prescribe, shall be governed by mayors and municipal councils, to be elected by the people of the municipalities, each municipality to be free from control in the exercise of the powers of local government, except as it shall be controlled by statute, and except as its officers shall be liable to removal by the governor in case of failure to faithfully perform their duties, and with power in the governor, in case of such failure, to order a new election and to fill vacancies in the meantime.

Legislature.

The question whether there might not now be provision made for a legislature elected by the people of the island is not free from doubt, but in view of their present inexperience it would be better to postpone such a provision until the people can have had an opportunity for exercise in municipal government, and until the first formative period of adapting the laws and procedure of the island to the new

conditions shall have passed under the direction of a council composed of Puerto Ricans selected for their known capacity and wisdom, and Americans from the states competent and experienced in dealing with legislative and administrative problems. The constitution of such a legislature should be contemplated as a step to be taken in the future.

Wherever it is necessary to employ Americans, except in the chief offices, a system of civil-service examination should be provided, under which requests from the governor of Puerto Rico for persons to be appointed may be filled.

The answer to the question, "What shall be the treatment of the municipal law of the island, and how far shall the laws which now regulate the rights and conduct of the people be changed to conform to ideas which prevail among the people of the United States?" presents little real difficulty. The civil code established by Spain for Cuba, Puerto Rico and the Philippines, and in force at the time of the cession, is an excellent body of laws, adequate in the main and adapted to the customs and conditions of the people. It should be continued in force with such gradual modification as experience from time to time suggests to those who are actually engaged in enforcing it.

Congress has the legal right to regulate the customs duties between the United States and Puerto Rico as it pleases; but the highest considerations of justice and good faith demand that we should not disappoint the confident expectation of sharing in our prosperity with which the people of Puerto Rico so gladly transferred their allegiance to the United States, and that we should treat the interests of this people as our own.

CUBA.

Definite steps were taken in the course of the first six months of the year 1901, by the Congress of the United States and by the Constitutional Convention of Cuba, to determine the future relations of the two countries. The so-called Platt amendment to the army appropriation bill was adopted by the United States Senate, February 27, by a vote of 43 yeas to 20 nays and agreed to by the House March 1 by a vote of 159 yeas to 134 nays.

The Cuban convention was at first strongly opposed to accepting the conditions laid down by the amendment and sought to have them modified in several material respects, but finally, on the 12th of June, by a vote of 16 to 11, agreed to them without qualifications of any sort. This result was brought about by the report of a commission which had been appointed by the convention and sent to Washington in April to confer with the President on the relations of Cuba and the United States. Briefly, the Platt resolutions provide:

Terms of the Bill.

1. That Cuba shall not enter into any treaty or other compact with any foreign power which will impair the independence of Cuba and shall not permit any foreign power to obtain lodgment on the island in any manner.

2. That Cuba shall not incur a public debt beyond the ordinary revenues of the island.

3. That the United States may intervene to preserve Cuban independence and protect life, property and individual liberty.

4. That all the acts of the United

States during the military occupancy of the island shall be ratified.

5. That sanitary plans to prevent the recurrence of epidemics shall be carried out.

6. That the Isle of Pines shall be omitted from the Cuban territory, the title thereto being left for future adjustment.

7. That the United States shall be permitted to buy or lease lands for naval or coaling stations on the island at points to be agreed upon.

8. That these provisions shall be embodied in a permanent treaty with the United States.

CONSTITUTION.—On the 21st of February the Constitution as adopted by the convention was signed by the members of that body. The instrument is in the main like that of the United States. It provides for a republic of six states, coinciding with the six old provinces of Havana, Matanzas, Pinar del Rio, Puerto Principe, Santa Clara and Santiago.

The election law occupied the time of the convention until September and had just been completed when President McKinley died. It provided for a general election December 31, 1901, at which representatives in Congress, provincial councilors and governors and members of an electoral college are to be chosen by direct vote. The electoral college will meet February 21, 1902, to choose a president and vice-president of the republic and members of the senate, of whom there are to be six from each province.

First President.

The most prominent candidate for the presidency at the close of the year was Estrada Palma, who represented Cuba in the United States at the time of the revolution. He was afterward elected, as elsewhere stated. The convention having completed the work for which it was summoned was formally dissolved by Governor-General Wood October 3.

AREA AND POPULATION.—The total area of Cuba is 35,994 square miles. The population in 1899, when the last census was taken, was 1,572,797, distributed among the six provinces as follows:

Havana	424,804	Puerto Principe	88,234
Matanzas	202,444	Santa Clara	356,536
Pinar del Rio	173,064	Santiago	327,715

Population of principal cities:

Hanava	235,981	Matanzas	36,374
Santiago	43,090	Puerto Principe	25,102
Cienfuegos	30,338	Cardenas	21,940

About 67 per cent. of the population is white.

EDUCATION.—The public schools of Cuba have been under the direct charge of Lieutenant Matthew E. Hanna since 1899, and are rapidly growing in number and efficiency. At the close of the war public education was at a standstill; at the close of 1900 there were in the island 3567 school-rooms and the same number of teachers, with a total enrollment of 172,273 pupils.

Teachers, schools and pupils were distributed among the provinces as follows:

Provinces.	*Teachers.*	*Schools.*	*Pupils.*
Havana	904	904	41,383
Puerto Principe	246	246	9,355
Santa Clara	879	879	44,872
Santiago de Cuba	645	645	33,983
Pinar del Rio	274	274	13,282
Matanzas	619	619	29.398
Grand total	3,567	3,567	172,273

The averge salary per month paid to men teachers is $49.91 and to women $47.73.

Since the Spanish evacuation there have been no strictly military operations, and the officers of the army in Cuba were largely occupied in conducting, under the direction of the military governor and the department commanders, a general civil

administration, for which no other governmental machinery existed, and in aiding the existing municipal governments in the performance of their duties.

For the present there is no disposition on the part of the United States to annex the island. The promises made at the outbreak of the war with Spain will be literally fulfilled. Cuba will be free, and a party in favor of annexation will be formed in the United States favorable to the admission of the island to the Union.

THE PHILIPPINES

Claim to government by insurgents in the Philippines can be made no longer under any fiction. Its treasurer, secretary of the interior, and president of congress are in our hands; its president and remaining cabinet officers in hiding, evidently in different central Luzon provinces; its generals and troops in small bands scattered through these provinces, acting as banditti, or dispersed, playing the role of "amigos," with arms concealed.

Since that time our troops have been actively pursuing the flying and scattered bands of insurgents, further dispersing them, making many prisoners, and releasing many Spanish prisoners who had been in the insurgents' hands.

It is gratifying to know that as our troops got away from the immediate vicinity of Manila they found the natives of the country exceedingly friendly, and both men and animals were able to live upon the country and for considerable periods leave their supply trains behind.

Wherever the

Permanent Occupation

of our troops has extended in the Philippine Islands, civil law has been immediately put in force. The courts have been organized, and the most learned and competent native lawyers have been appointed to preside over them. A system of education has been introduced and numerous schools have been established. It is believed that in the city of Manila a greater number of good schools, affording better facilities for primary instruction, exists to-day than at any previous time in the history of the city.

The commissioners appointed by the president to study the government of the Philippines returned, and congress proceeded at once to take action upon the question of replacing the military with a civil government.

THE HAWAIIAN ISLANDS

For a considerable time after the queen of the Hawaiian Islands had been deposed from her throne the liberal party in the islands, made up largely of Americans and Europeans, repeatedly petitioned the government of the United States for annexation. Early in 1898 the provisional government sent to this country a commission to bring about the desired junction of the two governments. Debate was hot in congress for some time, and several treaties were drawn up and pending. Upon the explosion of the Maine in the harbor of Havana, however, the administration was so aroused that as a war measure it was decided to annex the islands. Accordingly, June 11, 1898, the house passed a resolution by a vote of 209 to 91 to take

Possession of the Islands

ceded by the provisional government, the senate concurring July 6, by a vote of 42 to 21. August 12, this government officially lowered the old Hawaiian flag and set our own stars and stripes over the government buildings, and administered the oath of allegiance to the national

guard. The resolution under which the islands were annexed stipulates that "until congress shall provide for the government of such islands, all the civil and judicial and military powers exercised by the officers of the existing government in said island shall be vested in such person or persons and shall be exercised in such manner as the president of the United States shall direct." The existing treaties with foreign powers were to cease, and be replaced by those of the United States; municipal legislation not inconsistent with the resolution or with the constitution of the United States was to remain in force until congress acts; customs duties were to remain in full force; the public debt was to be assumed by the United States, not, however, to a sum greater than $4,000,000. The Chinese were at once barred from further immigration.

A Joint Commission

was to be appointed by the president to study the laws and customs of the islands, and report to the congress of the United States for legislation. For this purpose $100,000 was appropriated by our government, and President McKinley appointed Senator Cullom of Illinois, John T. Morgan of Alabama, Representative Robert H. Hitt of Illinois, Ex-President Dole of Hawaii, and W. F. Frear of Hawaii, as the joint commission. This commission studied the nature of the islands, and from their reports congress proceeded to enact measures for governing our new possessions.



STREET SCENE IN HAVANA

TRAVELING IN THE AIR

MODERN SCIENTIFIC KITES AND FLYING MACHINES.

Wonderful development toward solving the problem of Aerial Navigation. Travel through space at enormous speed assured in the near future.

SCIENTISTS and mechanical engineers are looking for some one to bring to perfection a pactical flying machine or air ship. They no longer laugh at the idea that earial flight is a possibility, but instead say that it is not only a possibility but a strong probability. The reason for this is that a number of men have been steadily experimenting for the last decade upon kites, aeroplanes and balloons, with the idea in view of being able sometime to direct them at will. Otto Lilienthal, a German inventor, came as near, perhaps, to perfection as any one yet, while Maxim, the gun inventor, has been to some extent successful. The latter built a machine eight feet wide and forty feet long, which by propulsion by screws made a number of flights.

Lilienthal's Method

not only was successful in propelling to some distance a machine through the air, but also carried its inventor. His outfit consisted of several large "planes" made of light wooden frames covered with cotton cloth, the whole apparatus much like four outspread wings of a huge bird. They were in two sets, one above the other, connected by vertical rods, and at the back between the two extended a large, cloth-covered rudder, which also had horizontal planes. The operator held on to the lower set, clasping levers to the wings by his hands, while at the same time he was supported by cushions under his arms, thus leaving his legs free and dangling in the air. The affair weighed from thirty-five to fifty-five pounds, and was intended for jumping from a high tower, somewhat after the style of a parachute, only as the flyer started off into space he might work the levers, which in turn manipulated the planes, and sent him shooting out at an angle, or soaring up again or around in circles, just like a bird.

Near Berlin, Lilienthal built a tower about fifty feet high on a hill, and from this he sailed as far as six hundred feet in easy winds, sometimes against heavy winds, and on several occasions he reached a height greater than that from which he started. These experiments, though they advanced the science of aeronautics, at last resulted in the inventor's death by collapse of his machine.

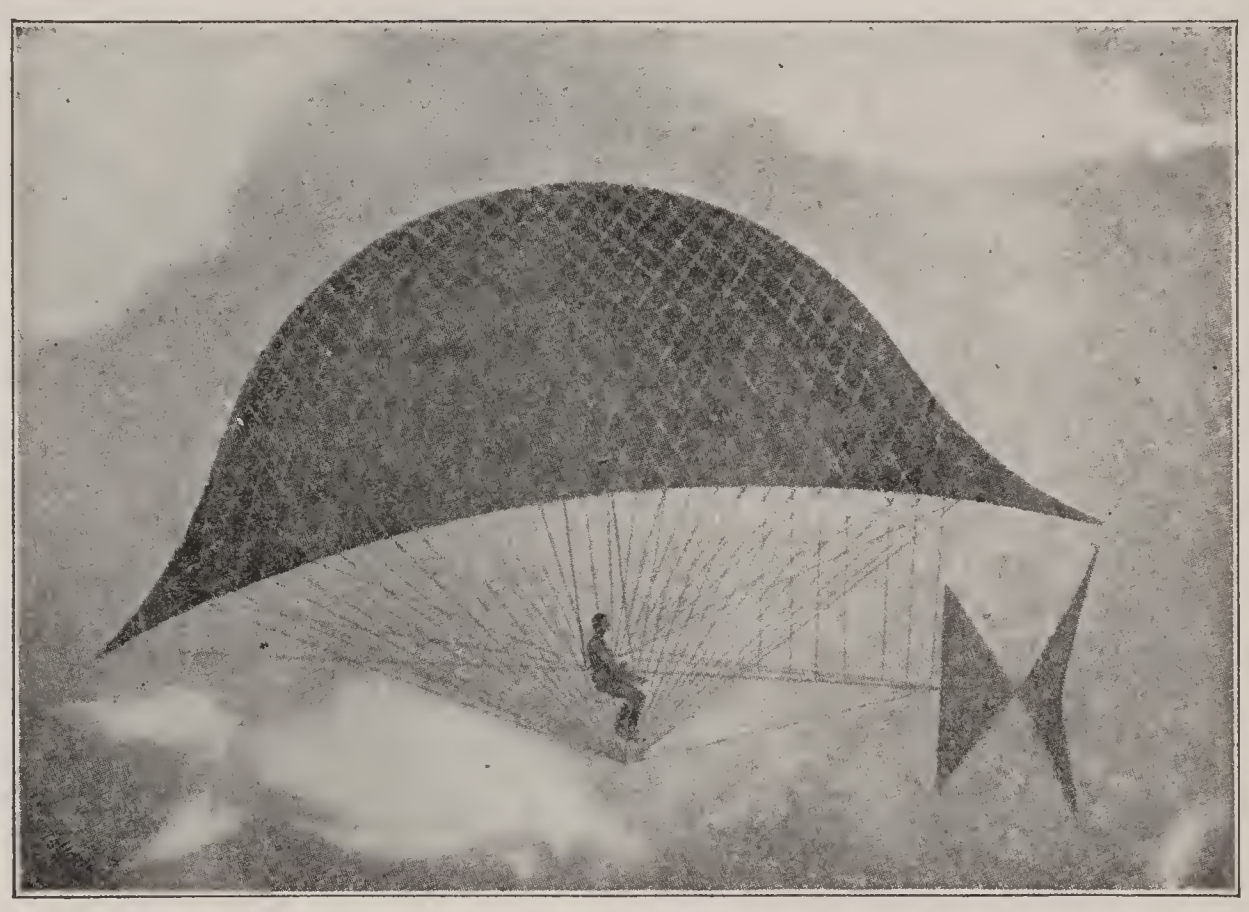
Professors Chanute and William Paul

some years ago conducted a series of aeroplane flights at Dunne Park, Indiana, on the shores of Lake Michigan, which were in the main successful. No motive power was used, the principle being that a slide down hill would lift the plane a distance into the air, and then by other planes and rudders, the machine was kept in the air for some time.

Paul has also invented one of the most perfect tailless kites of late years. It is called

The "Fin" Kite,

and consists of two planes, one intersecting the other at right angles, so that there are presented to the wind four fins, two lateral, one at either side, and two perpendicular, one above and one below. The connecting band is attached at the ends of the perpendicular fins, and when the kite is raised it exerts a very powerful pull, and has hardly any wavering motion. Heavy logs have been pulled across Lake Michigan in tow of the kite, and the inventor contemplates a voyage himself in a small iron open boat.



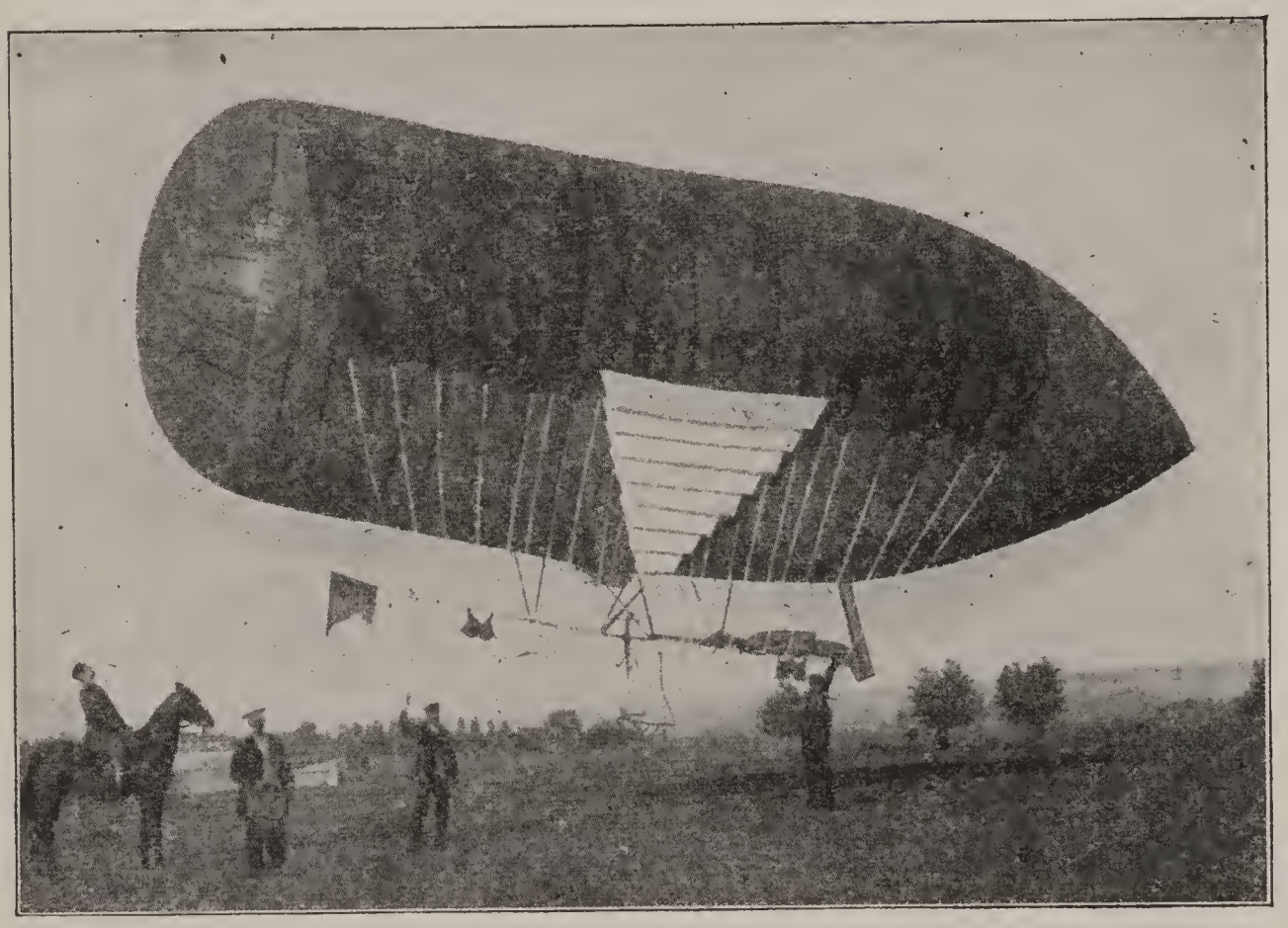
A GAS-KITE BEING PROPELLED THROUGH MID-AIR.

Probably the best experiments, or those that have borne the most useful results, are those made by the war departments of this country and Europe. The use of the kite has been remarkable in past years. Franklin by its aid drew electricity from the clouds; Peacock dragged a little carriage by one, and others have suggested life-saving apparatus with kite connection. But it has really been only in recent years that huge kites have been constructed with the sole purpose of experiment.

The great variance in wind pressure under different conditions makes it rather difficult to figure accurately on flights. Tails for a long time were considered necessary, but of late years this hindrance was done away with. The fact that tails were not necessary was discovered purely by accident. A famous kite-flyer had built a huge affair of 500 square feet with an immense tail of brush. At the first attempt at flight the tail became entangled in a tree. The kite came to ground, and the disgusted maker resolved to try another tail, when a gust of wind came along and took it up in the air, where it flitted about unsteadily, but rather successfully, though without an appendage.

The material for building is varied, sometimes the frames are made of bamboo, sometimes of metal, while the sails are often made from silk or cambric cloth, and sometimes even heavier material. The most successful flyers operate several

kites from one rope, thus giving great lifting power. Captain Baden-Powell, of the Scotts Guards, rigged up a series of five kites and attached a balloon basket to them which would lift two men to the height of 100 feet. Photographic apparatus has been attached to kites and bird's-eye views of the earth taken by manipulating strings from the ground. Pictures of birds in flight have also been made in this way. In large cities flags and advertising banners are flown from the supporting string, and in signal service corps occasionally signals are sent to distant camps by their means.



DANILEWSKY'S DIRIGIBLE FLYING MACHINE.
Showing wings and the bag inflated ready for a flight.

For years,—in fact, ever since the balloon was developed into a man-carrying flyer,—plans have been laid to make it so that it can be propelled and directed at the will of the operator. Huge cigar-shaped bags filled with gas have been floated to which were attached baskets of some sort containing propelling machinery and rudders. The general plans that seem to be followed the most are those which call for large planes or wings so constructed that they will help to support the ship, and also guide it by extending great enough surfaces so that conflicting winds will not beat them about. Screw propellers above and at the rear are generally used to draw the ship about.

The latest improvement in the line of

War Balloons

comes from Germany. That country took no interest in ballooning till 1884, whereas her traditional enemy, France, began investigations in the science of aeronautics at once after the war of 1870. However, Germany has made rapid strides in her experiments, with the result that the United States government is now buying one of the recent productions of her skill. The balloon in question is the invention of Captain von Parsval, a Bavarian, and First Lieutenant Sigsfeld, a Prussian. Hitherto the wind has been the greatest difficulty to overcome in this science. Even a moderate wind was sufficient to depress the ordinary bullet-shaped ship, the result being that it could not mount high, and was thus practically useless for military purposes. To surmount the wind difficulty, therefore, this ship has been made of great length, and of such nature that it rises in the air on a slant, somewhat like a kite. This odd feature has given the device the name of the "dragon" balloon. The main bag is filled with a buoyant gas which keeps the

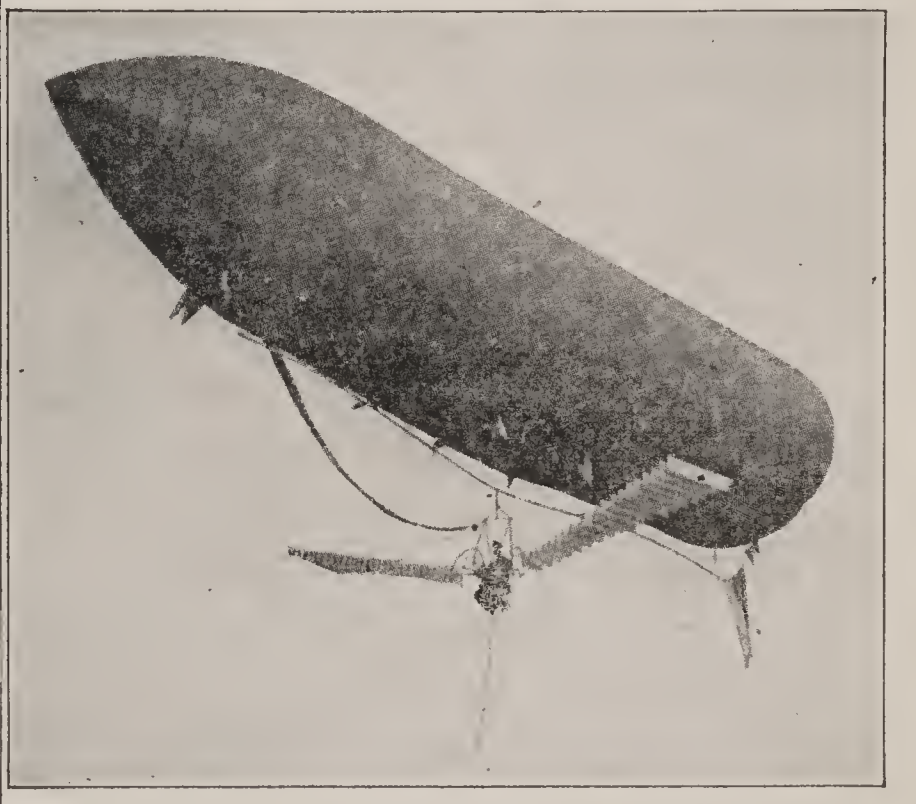
ship afloat, while at the rear and below it is a sack-like arrangement which is open to the wind, allowing it to pass through an aperture in the back, thus steadying in a great measure the balloon against heavy gusts of wind. The basket is hung to the rear end, and from it are run cable and telephone wires, thus weighting that end and keeping the whole ship in the air at an angle of 20 degrees to the horizontal. Ingenious devices are arranged inside the bag for keeping the pressure the same upon the sides at all times, this having been one of the greatest difficulties to overcome. At the sides of the bag are fins which in a great measure protect it from upward wind currents. A cable through which run insulated copper wires for telephone and telegraph communication, holds the balloon to earth and is reeled from a cylinder on a wagon. When the huge ship rises in the air, it can stand steadily in almost any direction desired, and in the face of heavy gales does not fly about. The benefits to accrue from such a contrivance are many; battles may be viewed from a distance; explosives dropped on the enemy, though this is prohibited in civilized warfare; fortifications inspected and photographed, and similar manœuvres.

Use of Liquid Air.

With the help of the motive power of the newly-discovered liquid air we may expect to have some sort of a dirigible airship before long.

Even now this expectation appears to have been fulfilled. Under date of July 13, 1901, the following account was transmitted from Paris:

There is scarcely room for even a shadow of doubt that M. Santos-Dumont has definitely solved the problem of aerial navigation. During a couple of hours yesterday morning he conclusively proved this by steering his new 'aeronef,' the Santos-Dumont, No. 5, through the air in every direction, north, south, east and west, turning to the right or left, wheeling round in wide circles above the Bois de Boulogne, and finally sailing off to the Eiffel Tower, near which a trifling accident to his rudder necessitated a momentary descent.



FLYING.
The wings being raised in mid-air and being propelled by occupant of the ship.

The accident only showed the more unmistakably the practical utility of M. Santos-Dumont's astounding invention. The airship came to earth as easily and lightly as a bird, and when the defective steering rope connected with the rudder had been repaired, it ascended again, made a complete turn upon itself and returned to its starting point, the Parc d'Aerostation, at St. Cloud.

M. Santos-Dumont had kept very secret his intention of making the ascension. It

was impossible to fix a day or hour beforehand, he said to me last evening at the Aero Club, in the Rue du Colisée, an association that does a vast amount of practical and invaluable work to advance ballooning in France.

"Perfect weather," he said, "is desirable for the first experiment. I have slept at the Parc d'Aerostation for the last two nights so that I might be ready to go up at the first favorable moment. Wednesday night was unsettled, and even last night a storm, luckily of brief duration, threatened to make a postponement of the ascension inevitable. However, it quickly blew over and a dead calm set in, so I decided to make the ascent.

Marvellous Achievement.

"My balloon was got out of the shed, and right after three o'clock the trial began.

"It appears," he added, with characteristic modesty, "that it was successful."

If M. Santos-Dumont was content with merely expressing satisfaction with the results of his experimental ascension, M. Emmanuel Aimé, a distinguished professor of sciences and mathematics and secretary of the Aero Club, was wildly enthusiastic.

"It is marvellous!" he exclaimed, again and again. "It is the one practical, really practical, attempt to make a dirigible balloon that has been an unqualified success."

M. Aimé is accepted all the world over as an authority on aerostation, and his opinion of the trial is consequently of the greatest value. This is what he wrote:

"During the last fifteen years no one in France, with the exception of M. Santos-Dumont, who came direct from San Paolo to Paris for the express purpose, has made an ascent in a really steerable balloon; that is to say, in a balloon provided with a motor and propeller. Thanks to the perseverance and tireless activity of M. Santos-Dumont, who was the first to utilize in aerial navigation the light motor used in automobiles, a practicable solution of this stupendous problem has just been found.

Skill and Judgment.

"To do thus, to create what may now be called the art of areomatics, nothing less than the experience, practice and remarkably cool judgment and self-possession of M. A. Santos-Dumont was absolutely necessary. For it did not suffice to build a navigable ballon. The more difficult thing was to make the ascension in it.

"From this point of view," continued M. Aimé, "the value of the man adds so materially to the value of the system that it was not hazarding too much to predict boldly the decisive success that has crowned M. Santos-Dumont's trial trip to-day.

"The balloon with which the experienced aeronaut experimented is the fifth of a series that he has constructed, each carrying out in a more highly developed form the idea that forms the basis of the system. Its principal characteristics are: Diameter, 11 feet; length, 103 feet; four-cylindered petroleum motor, 16 horse-power, propeller screw measuring 4 mètres from blade edge to blade edge, and making 200 revolutions per minute. The machine is supported by a triangular framework made of aluminum and strengthened with pine, measuring nearly 60 feet in length. It is formed of three curvilinear scantlings bound together and joined with aluminum, united by wooden crosspieces and solidified by an ingenious network of piano wire.

"At a distance of 22 feet from one extremity of the framework in the centre of a triangular section, the motor is suspended by means of piano wire that causes it to bear a vague resemblance to a gigantic spider in its web. At the same distance from the other extremity is situated a basketwork car, in which the aeronaut takes his place, and where he commands the arrangements for lighting the motor and for starting the screw propeller. Cords work the rudder, controlling the escape valves and regulating the displacement of the guide rope from bow to stern, if I may use the term, by means of fine cords. The framework, with its motor and aeronaut's car, is suspended to the balloon by steel wires of such tenuity that they are invisible at a distance of 150 feet in the air.

"Let Go."

"At three o'clock in the morning the balloon was guided during a period of perfect calm from the Parc d'Aerostation, at St. Cloud, to the Long Champs race-course, and was given final touches in the presence of M. George Besancon, director of the 'Aerophile,' the organ of the Aero Club and of French aerostation, M. Gustave Hermite, several officers from Versailles and Mont Valerian and myself. The words 'let go!' were uttered by M. Santos-Dumont, who was alone in the car of the balloon. There is not room enough in it for an aeronaut much bigger than its designer.

"The words were the signal for the commencement of a series of experiments of the most conclusive character, which surpassed in importance any that have been made from the days of Montgolfier up to the present time. Six consecutive times the aeronaut made a complete circuit of the Long Champs race-course.

"It was proved that the airship has an average speed of 24 miles per hour; that it answered its rudder with most perfect obedient docility, and that the problem of landing was solved, each voyage round the race-course rigorously ending with a descent at a spot indicated beforehand. It returned time and time again to the previously designated spot, just before the tribunes, with mathematical precision.

Sailed Away.

"When M. Santos-Dumont had accomplished all these evolutions he turned the head of his balloon in the direction of Puteaux and sailed off to that place. Then he turned round sharply and came back to the starting point before the tribune.

"After taking in a fresh supply of petroleum, he made off toward the Eiffel Tower and reached it, at a distance of three miles in ten minutes. While over the Champ de Mars a slight accident to his rudder compelled M. Santos-Dumont to come down in the Trocadero Gardens. A tall ladder was very obligingly brought by some workmen and M. Santos-Dumont climbed up it to repair the defective part. When this had been done he started off again swept completely round the Eiffel Tower and came back at a breakneck speed to the tribunes on the Long Champ race-course, in order to reassure his friends who were alarmed at his long disappearance.

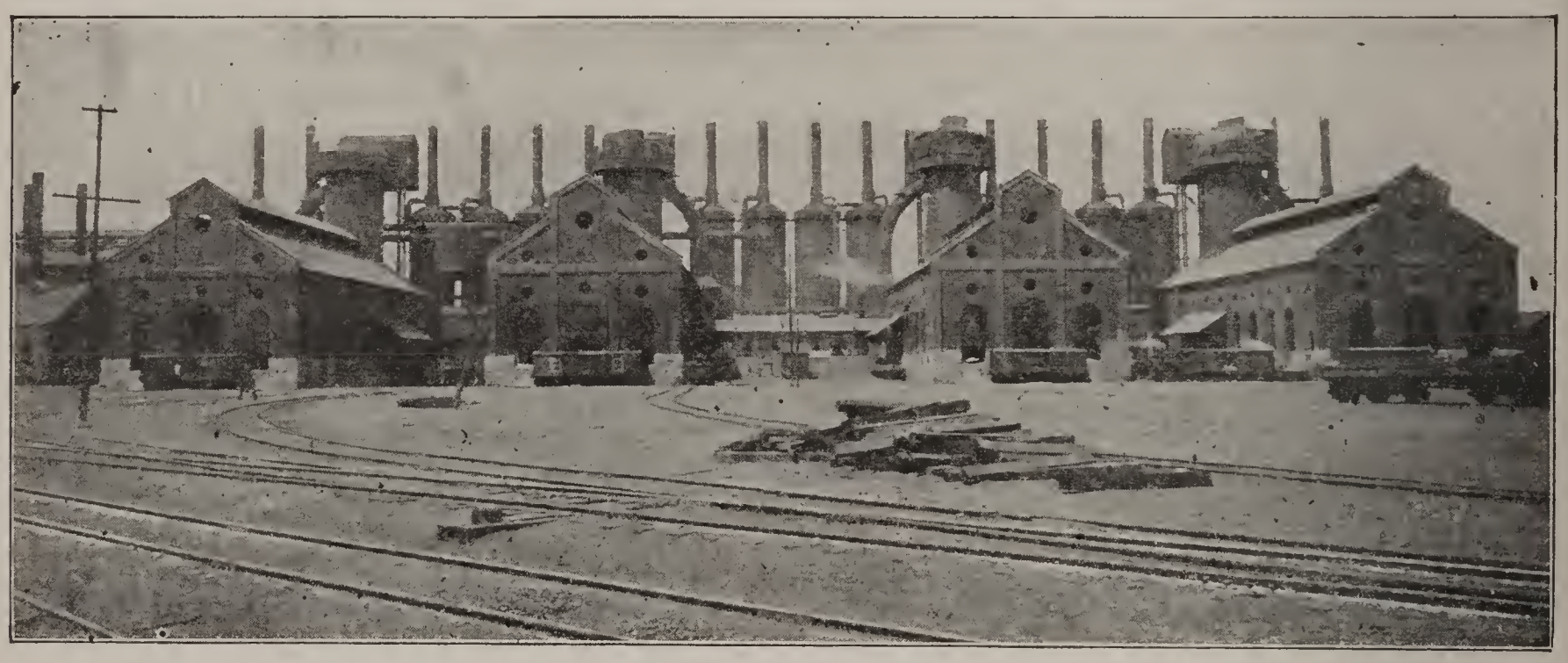
"Including stoppages, the voyage lasted one hour and six minutes. After a little rest, M. Santos-Dumont started off toward the rising slope behind Longchamp, crossed the Seine and brought back his airship to its home port.

STEEL ROLLING MILLS.

From crude iron ore to shining steel rails. How work is done in one of America's greatest industries. Millions made and invested in nature's great product.

NIGHT is the time when one should watch the process of converting crude iron ore into the long black steel rails that are destined to span the country. No display of fireworks can equal the grandeur of the great crucibles vomiting forth their masses of fiery metal. Many times the glow on the sky from these great mills can be seen great distances, and the reflection on the clouds often resembles a mountain on fire. The work in these rolling mills is hard in its nature, and to some degree dangerous, yet the workmen love it and take a pride in the fine little scars that seam their breasts, the result of their working stripped to the waist in a shower of sparks.

When a load of ore arrives from the mines it is brought up on side tracks where men with wheelbarrows can easily cart it down to the melting room. This is a great roomy place with no walls to speak of, and nothing but a sand floor. In one end of the room, reaching high up in the air, is the "cupola." In some mills this is fifty feet high. It is cylindrical in shape, like an enormous boiler



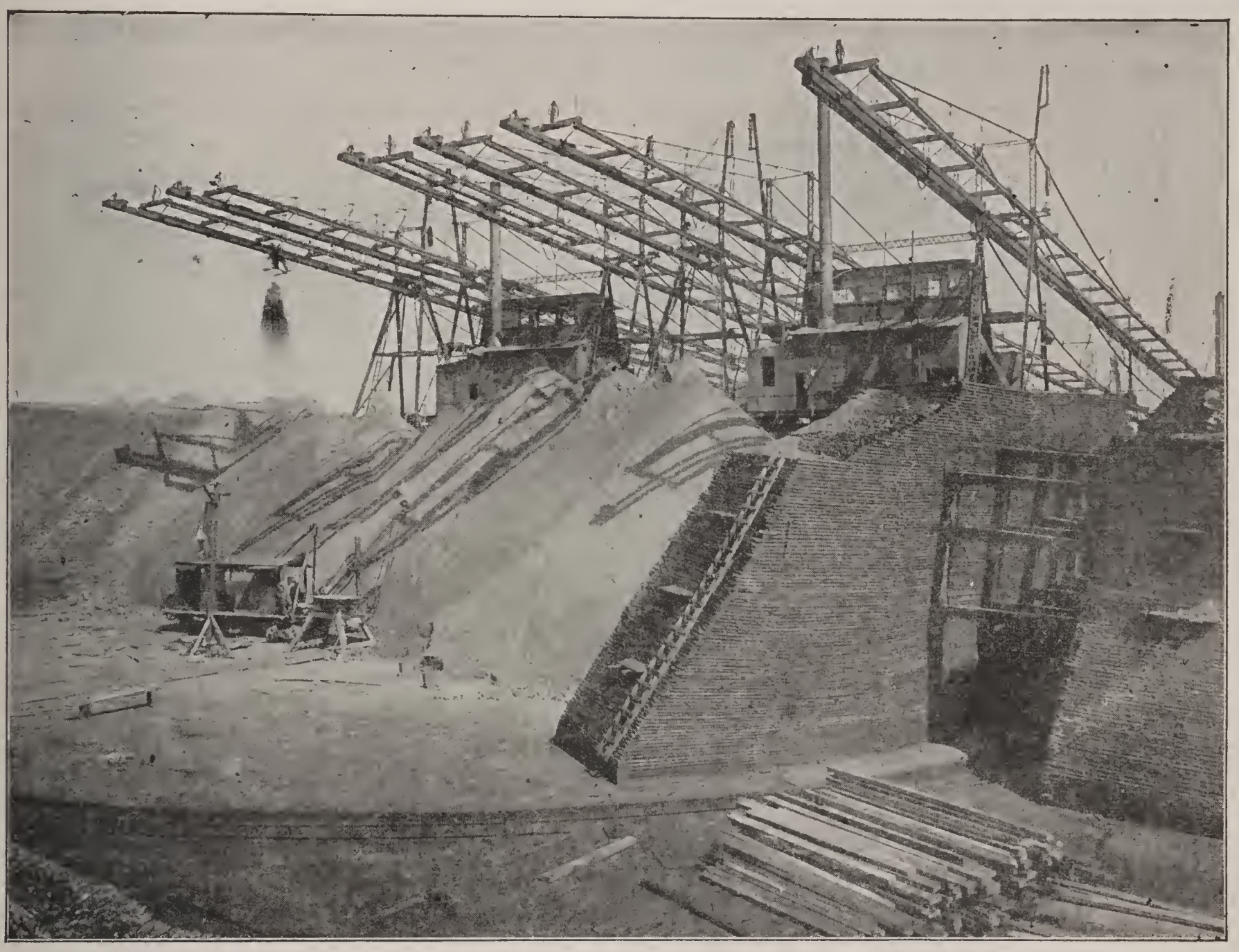
BLAST FURNACES.

The towers with the cupolas are the blast furnaces. Between the blast furnaces are seen the hot-air furnaces, of bottle-like appearance. Inside the four buildings (each one connected with a blast furnace) are cast the steel billets and ingots, which are later run through the mills and rolled into plates, rails or rods.

set up on end, and is lined with firebrick. The bottom has a sand bed, and just above this enters a blast pipe through which rushes the current of air that is to make the fire "blow." At the top of the cupola is a stack out of which the smoke and gases escape, and a little lower down, out, and just above these and running around the base are a number of holes or slits, called "tuyeres," surrounded by a wind box. This wind box is attached to the blast pipe and aids in the "blow."

The Cupola

man starts a fire of kindling wood and



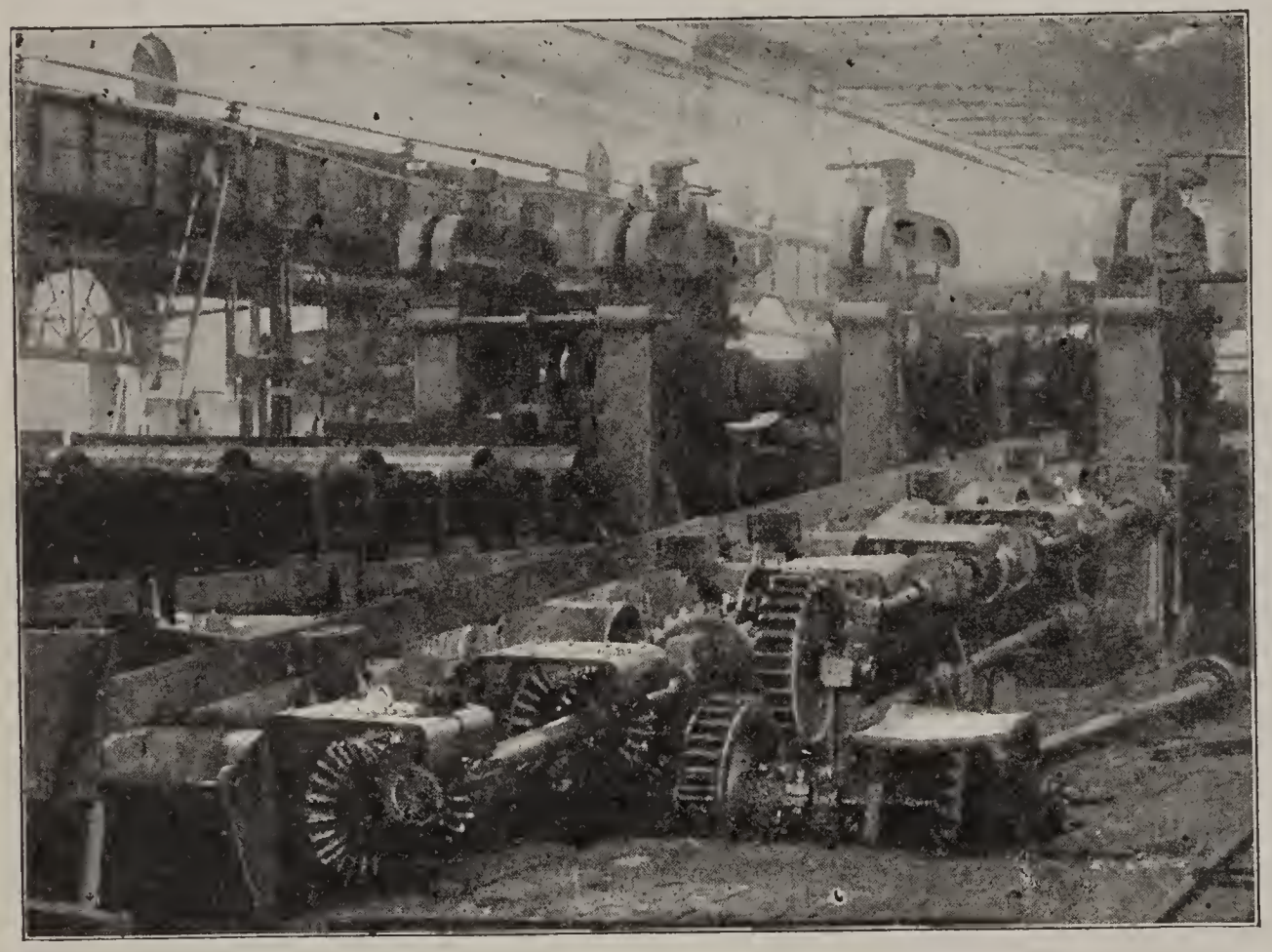
UNLOADING IRON ORE.

This picture shows the trams over which the ore is carried in large buckets from the ships and dumped into the ore pile within the yards of the steel works. From these great heaps the ore is later taken to the blast furnaces for conversion into pig iron.

running around the cupola, is a platform called the "charging floor." An opening in the cupola even with this floor is called the charging "door," and it is here that the ore, coke and lime are dumped in when a melting is to take place. At the bottom of the cupola are a tap hole and a spout at which the molten metal runs

coke, and when he has it going well he dumps down through the charging door alternate loads of coke, lime and iron ore. When the cupola is nearly full and the blast is working well, the cupola man sits down with his pipe, to watch. Gradually the ore is heated through and begins to yield; and here comes in the use of the

lime. Many impurities, especially sulphur, are in the ore, which, if not removed, would make the iron too hard or too soft. The lime seems to have an affinity for these substances, and as the ore melts it takes them up, together with particles of the coke, and lets the melting iron run down to the sand bed at the bottom. At the tap hole, just above the wind box, is an opening covered with mica, where the process of melting can be watched by the cupola



A STEEL RAIL MILL.

The steel ingot passes back and forth between the sets of immense rollers until it is finally delivered, at the left of the picture, a perfect steel rail, ready to do its part in the transportation of the world's products.

man. When he sees the first sign of dripping, he plugs the tap-hole up with clay, and then waits a little longer till he is ready to unload.

In the meantime men have been preparing the sand floor of the room into long troughs, one leading from the other, and all joining in one main trough that ends just under the spout of the cupola. Now the charge is full, and a man with a big mallet strikes the plug of the spout a blow. Out rushes the stream of fiery metal into the troughs to cool. Men with great wooden sabots for shoes, or boards on their feet, run about among the troughs and cover the iron with sand. As it cools somewhat by streams of water being thrown on the sand, these men run along over the iron and break it into short lengths or "pigs." These pigs may be shipped to foundries or other mills for casting.

At the steel mills, however, much of the iron is not cooled into pigs, but drawn off into little brick cars and carried at once to the steel-converting crucibles, thus saving a second heating. The cars run along rails that carry them right up to the top of another cupola-like affair. Here the iron is poured in, and a

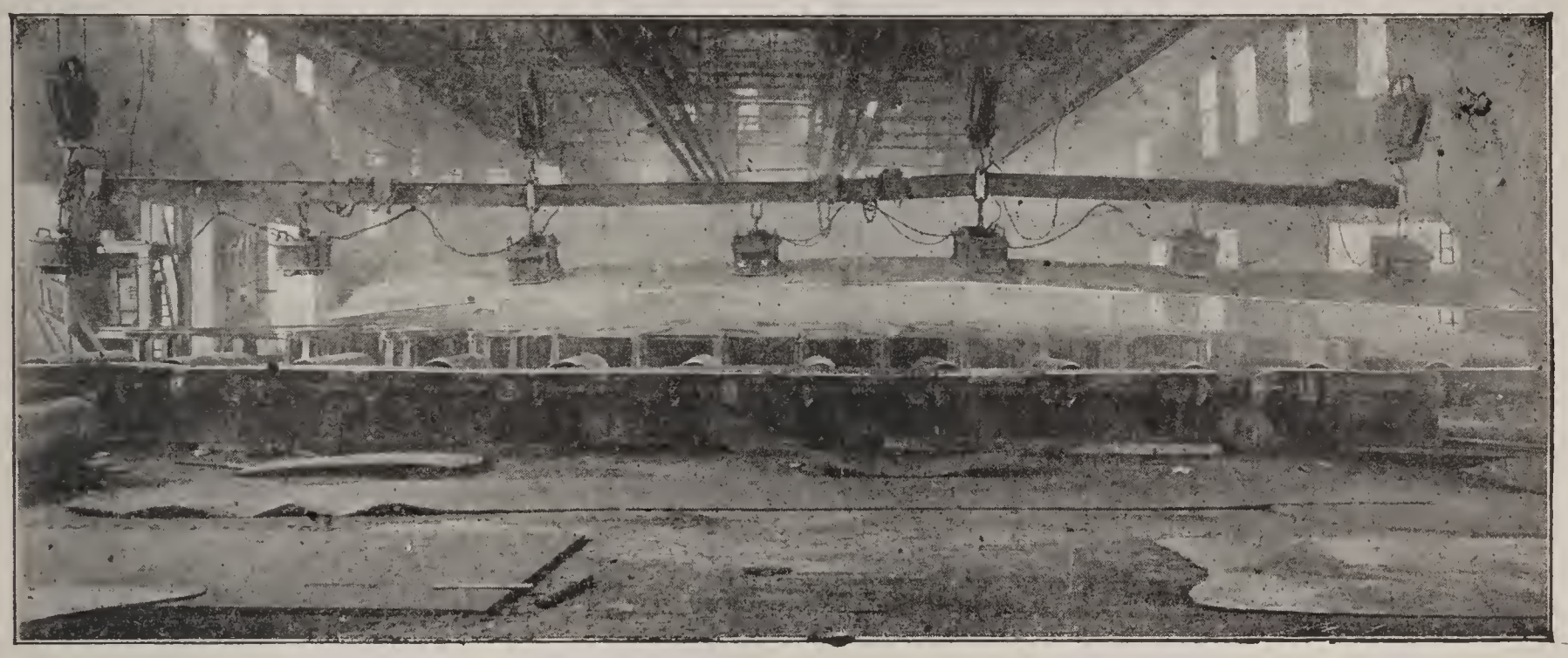
Tremendous Blast

set going. Sometimes oil is used to get the desired heat. Then a man comes along with a ladle full of "spiegeleisen," which is a combination of carbon manganese and other chemicals that works the great process of changing iron into steel. There are three grades of iron product: malleable or wrought iron, which is simply iron as we know it in pigs; steel, which is iron with an addition of 1 to 1½ per cent of carbon; and cast iron, which contains about 4 per cent of carbon. The more carbon added the harder and more brittle the substance becomes. When the carbon has been poured in, the blast spouts up for a while longer, and then the cupola, which is hinged, tips

over and with a shower of sparks the bright red steel flows out about as thick as tar into big oblong molds set on the sand floor, which, however, have only four sides and no top or bottom. There are generally a dozen or so of these molds full of glowing steel arranged in a circle on the floor waiting to cool. When their contents are sufficiently cool to handle, the molds are picked up by great cranes and tongs, and swung over to brick-covered cars. Here the steel "ingot," as the lump is called, is knocked out of the mold, and sent on its way to the rollers, while the mold is dropped back to its place to receive another charge.

In Making Steel Rails,

numerous rollers, each a little smaller than the one before it, are arranged in successive rooms. The red-hot ingot is dumped from its car on to a continuously



MAGNETIC TRAVELING CRANES.

Some steel plates are so large that they cannot be carried by hand ; consequently powerful electro-magnets are so arranged that—by the simple push of an electric button—they descend, and, grasping the hugh plates, convey them to any part of the mill desired.

travelling bed with arms sticking up from its chains. These pick up the ingot, and with the aid of a man who pushes with a crowbar, the mass of metal is run between two great rollers and reduced in width and thickness but greatly lengthened. This process is repeated again and again, each time the size diminishing one way but increasing another. Finally the rail begins to take on a shape, with flanges at the bottom and T-shaped head. Then the name of the mill is stamped in and holes are punched in the sides, so that they may be handled better when laid on the tracks. Then comes the sawing apart, by highly tempered saws lubricated with oil. The rail is gradually cooling all this time, and as it cools it warps. To overcome this it is placed in vises and straightened. The time occupied from the moment the hot iron metal leaves the ore-refining cupola till it is formed into heavy, perfect rails is, in a rush season, but a few hours.

PHOTOGRAPHY IN 1901.

PICTURES OF LIGHTNING, ELECTRIC SPARKS, OBJECTS TOO SMALL TO BE SEEN, AND OBJECTS AT A DISTANCE FAR BEYOND THE REACH OF THE HUMAN EYE.

IN the last few years many important inventions have been made in photographic circles. The X-rays are used in methods peculiar to the realms of photography. New sensitive papers have been introduced, especially the rough gray platinum kinds that give the effect of steel engravings. More improved plates for making exposures have given results never before dreamed of. Beautiful pictures of the heavens and nature are the result. Among other odd subjects for the camera are the lightning-flash and electric sparks. Meteorologists have been much interested in the results of pictures of lightning, and among other conclusions arrived at regarding these familiar electrical discharges is that they are crooked as they appear, and not, as some would have us believe, straight with



VIEW OF A COCOANUT-TREE TAKEN WITH AN ORDINARY CAMERA AT A DISTANCE OF 200 FEET.

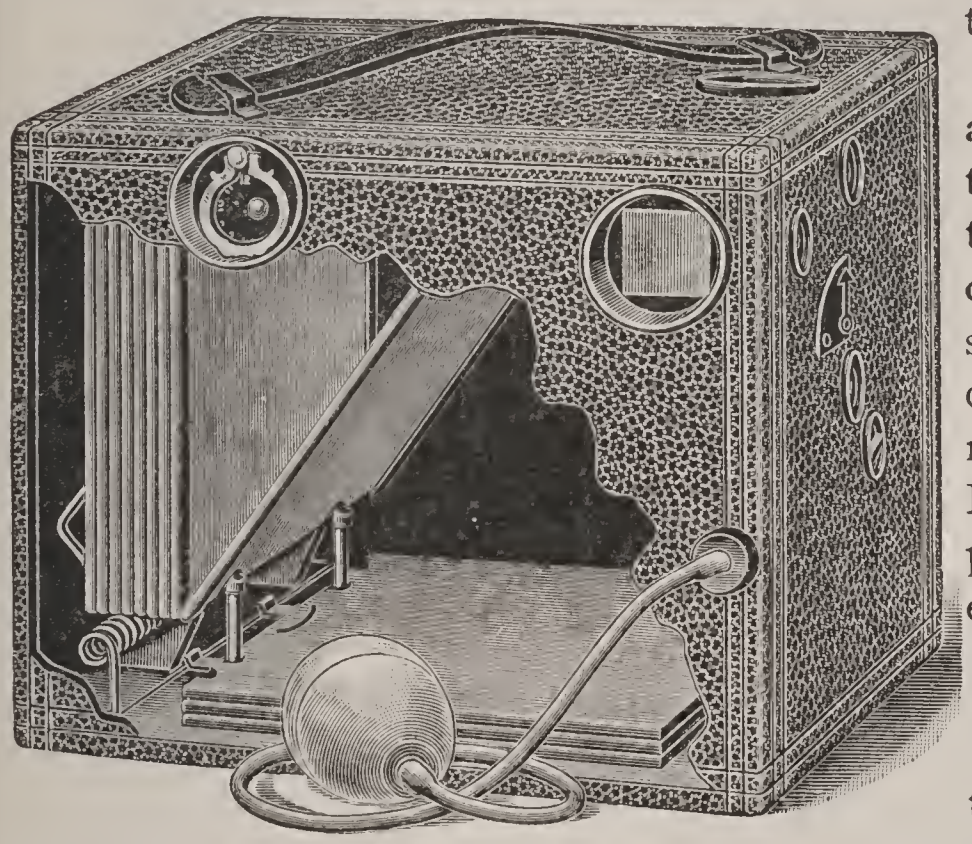
a crooked effect from the background of clouds.

Electographs,

or pictures of electric sparks, are of great interest to scientists. These are produced by exposing a sensitive photographic plate to the path of a spark jumping from the poles of a static machine. The plate is enclosed in a dark envelope, and placed between the poles of the machine at right angles to a line that would connect them. The spark leaps out, punctures the envelope, exposes the plate, and rushing over the edge of the plate, leaps across through the air to the other pole.



COCOANUTS ON THE TREE. VIEW TAKEN WITH TELEPHOTO LENS, SAME DISTANCE.



One of the latest snap-shot cameras, arranged for carrying twelve plates without reloading. A pressure on the bulb operates the shutter which exposes the plate. Then the little screw at the upper left hand corner is turned one notch, and the plate is dropped down on the bottom of the camera, leaving a fresh one at the proper place ready for another exposure.

Some peculiar properties of electricity are thus learned; among others that electricity follows the line of least resistance through its conductor, whether it be air or of another sort, but in so doing it selects a number of special paths mutually divergent from each other, and hence does not travel in a mass through its conductor. From these experiments laws are expected soon to be formulated which govern this freakish fluid.

The Telephotograph.

Many instances arise where, because of the remoteness of the subject to be photographed, the operator secures very poor pictures, with only faint outlines, or at the best very small reproductions. To do away with this difficulty a new process, called telephotography, has come into use. It came about partly through the use of

ordinary field glasses and telescope for observing with the naked eye, and later on with photographic attachments to the great glasses in observatories. Now, however, cameras are made that may be carried around from place to place, and yet so arranged that if the view to be photographed is across a wide river, the far-seeing lens is simply adjusted, and the telephotograph made.

lens, back of which is a small negative or concave lens. The negative lens is the one that does the far-seeing work, for it magnifies the object. This lens may be taken out if desired and the camera used for ordinary exposures. After a common picture has been taken, the operator may replace the negative lens, and upon his ground-glass screen will be seen the same subject, only a great deal nearer and



AN ELECTROGRAPH OR PHOTOGRAPHIC REPRODUCTION OF THE
LEAP OF AN ELECTRICAL DISCHARGE BETWEEN
THE POLES OF A STATIC MACHINE.

Dwight L. Elmendorf has been as successful, perhaps, as any one in taking views of this kind, and it has been largely due to his work in experimenting with telescopes that a good camera has been developed. An arrangement that he has perfected consists of a rack and pinion lens tube, 3¼ inches long and 1½ inches in diameter, enclosing a fine rectilinear

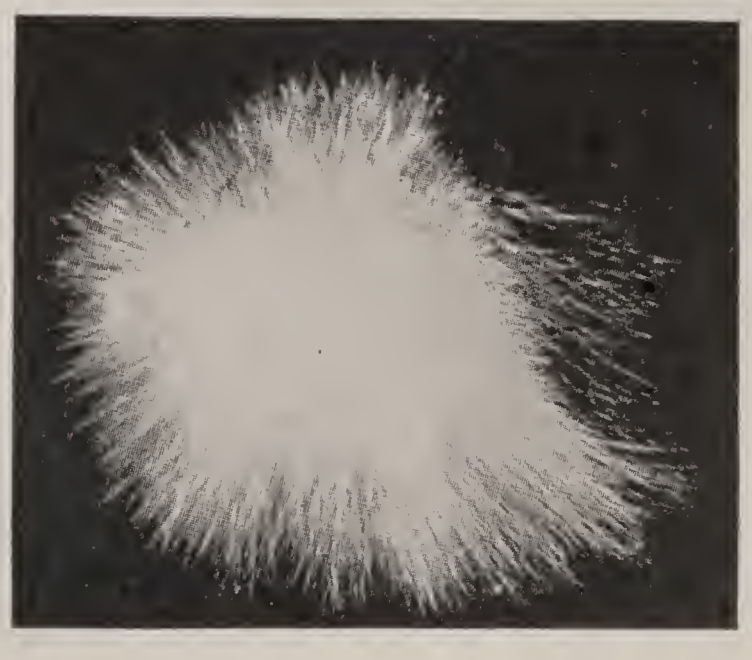
larger. If the outline is not quite distinct, by using the rack and pinion the regular lens may be moved forward or backward similar to an opera glass, and a perfect focus is obtained. Exposures with this kind of camera must necessarily be increased in length of time, for the reason that fewer light rays pass through the negative lens to the sensitive plate

This seriously retards taking pictures of moving objects at a distance, but ere long it will doubtless be overcome.

The uses to which this process may be put are various and wonderful. For pleasure alone the results are startling. Imagine yourself in the Alps, desiring to take a picture of a distant cap of snow miles away. Here is the means of gratifying this desire. In the war between England and the South African Republic, the former country used this process for taking pictures of camps and fortifications many miles off, and which could not possibly have been accomplished otherwise than by dangerous risk of fire from the Boers' guns. As soon as an apparatus is perfected that will take rapidly-moving objects, a kinetoscope attachment will be made that will enable the scientist to take and reproduce moving pictures of wild animals in their native haunts, and birds on the wing, long before they become aware of the approach of their enemy.

Microphotography

is rapidly coming to the aid of medicine. Heretofore it has been doubtful just what conditions existed in diseased tissues, but now, with camera and microscopes, lasting pictures may be made of life-destroying germs. The apparatus for such processes is simple, and even inexperienced amateurs may get beautiful results of flowers and animal life. A light tight box is arranged for the camera, with a very long bellows. At the end is attached a powerful microscope and farther up an



IMPRESSION OF AN ELECTRIC SPARK ON A PHOTOGRAPHIC PLATE.

ordinary photographic lens. The box must be held very rigid, for long exposures are the rule. When the plate is developed, one may see in great detail tiny objects not visible to the naked eye. These, when thrown on screens from magic lanterns, make beautiful enlargements.

Recent Occurrences

THAT HAVE MADE HISTORY.

The Rural Postal Delivery; British War in the Soudan; Arctic and Antarctic Exploration; Partition of China.

The Rural Postal Delivery.

THERE is nothing so remarkable in the history of the postal department as the recent growth of the free rural delivery. Within the last two years, because of the wish of the people whom it serves, it has so implanted itself upon the postal administration that it can no longer be considered in the light of an experiment. Some of the advantages derived from it are: Increased postal receipts, more letters being written and received, and more newspapers and magazines subscribed for, thus keeping people in country parts well informed on topics of the day, as well as better educating them. Land values are increased, in general about $2 to $3 an acre, because of better means of communication. Country roads must be improved for the carrying of mails, and here lies a great benefit to the farmer. In one county in Indiana the delivery was valued so much that the farmers spent $2,600 on grading in order to obtain it. Possibly the greatest advantage to the country man is better prices on his produce, because he can keep in daily touch with the market reports and can take advantage at once of high prices to sell. At the end of 1899 rural free delivery was in successful operation over 383 routes, radiating over forty states and one territory. The service was given to over 190,000 persons at an annual cost of about 84 cents a person. This was accomplished by an expenditure of $150,000, which was made available by an act of congress July 1, 1899.

British War in the Soudan.

The fanatically religious Dervishes, followers of the Mahdi and the Khalifa of Soudan, for eighteen years carried on a warfare with the English that was most discouraging to all attempts at civilization. The great Colonel "Chinese" Gor-

don in 1879 was governor of the country, and tried without success to quell insurrections. He was recalled to England, and at his departure new rebellion against the British authority broke out, headed by the son of a Dongola carpenter named Sheil Mohammed Ahmet, who called himself El Mahdi, the prophet of God. This man gathered under his banner thousands of fanatical Mohammedans, and ravished the country at the sources of the Nile River. England sent Colonel Hicks with 11,000 picked men against him, but the expedition ended in a massacre of the British. England, now awake to the enormity of the situation, sent Gordon back to capture and destroy the Mahdi. In 1884 he arrived at Khartum, was imprisoned, and before reinforcements under Gen. Sir Garnet Wolseley could arrive, had to surrender, and was then treacherously killed by the Dervishes. The Mahdi died the next year and was succeeded by Khalifa Abdullahi, who dispensed with the Mahdi's religious fervor, but lacked none of his wiliness. In 1896 the British renewed the war under General Kitchener, who, in order to carry the war into the enemy's country, built a railway over the desert, advancing as fast as it was completed, thus having a ready communication with civilization for supplies. In 1897 Berber and Abu Hamed were taken, and September 2, 1898, Omdurman, the capital of the Dervishes, fell. The following year, November 24, 1899, the Khalifa was killed in battle, and Lord Kitchener sent to London the terse message, "The Soudan may now be declared open."

TRYING TO FIND THE POLES.

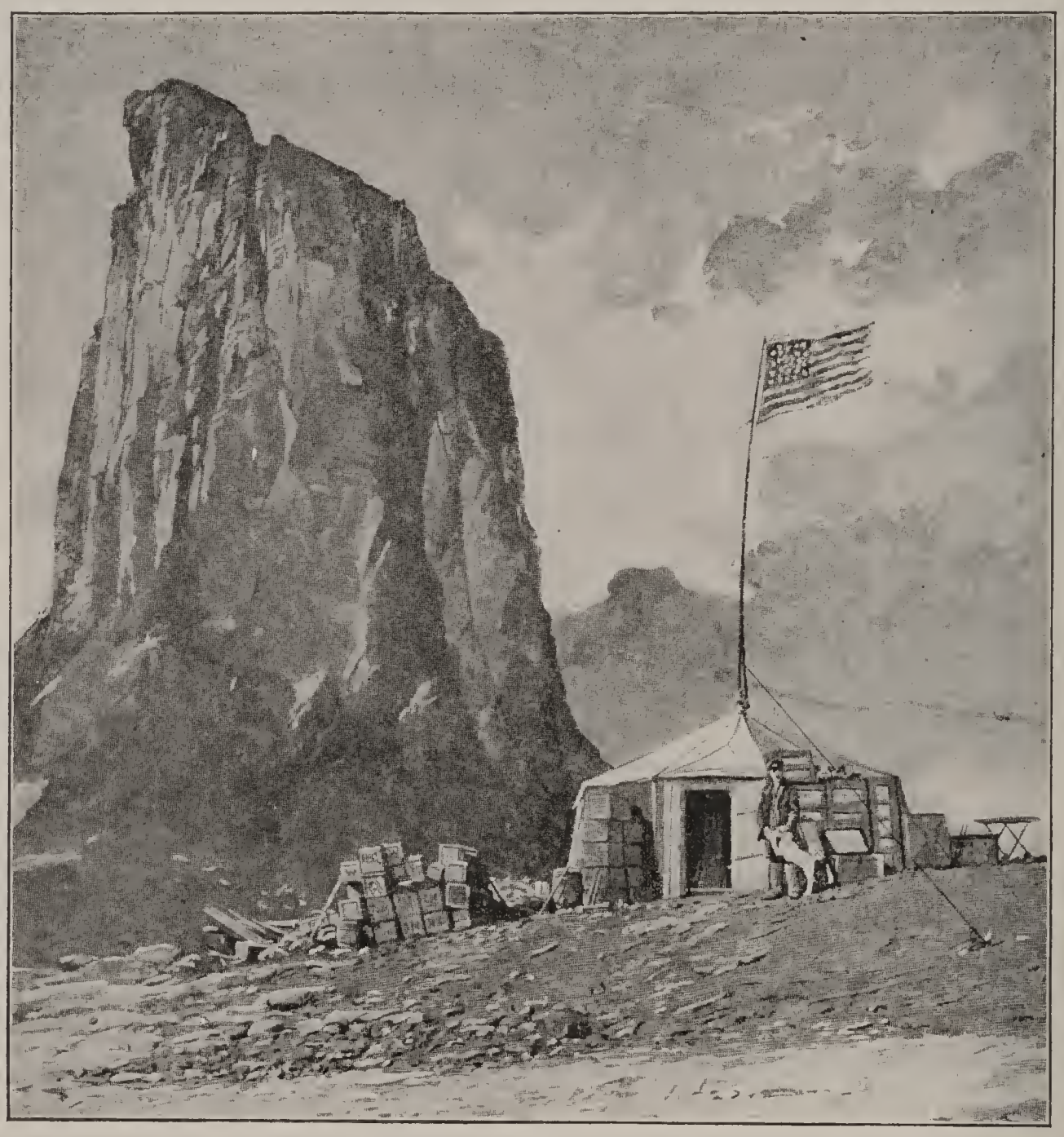
ARCTIC AND ANTARCTIC EXPLORATION.

OF all the baffling forces of nature possibly those experienced in polar expeditions are the greatest. For nearly three hundred years brave explorers have battled with icebergs and frozen seas, and all in the quest of those unknown lands about the poles. Of the many expeditions, successful and otherwise, those of Greely, Peary, Nansen, and Andrée are possibly the most important. America has given to the world much information on the Arctic Ocean, and Lieutenant Peary, of the United States navy, who is now in Greenland, has done as much for our glory in discoveries as any other. He made trips in 1886, 1891, 1894 and 1898, striving in the main to reach the North Pole by traveling across the land ice of Greenland. During the last trip, however, from which he has not yet returned, he intended to try a system of food posts, one after the other, farther and farther towards the pole. Andrée, who probably perished with his two brave companions, sought to reach the pole by balloon, figuring that the wind currents would carry him safely. His start was bad, however, and the last heard from him was a message taken from a carrier pigeon shot near Wadden Island, and which stated that July 13, 1898, the party was in good health. Nansen, a Norwegian, sailing under government instructions in the "Fram," used the method of drifting with currents toward the pole, and reached the farthest known point north, 86 degrees and 14 minutes, or within less than

four degrees of the object of all explorers' search.

The Antarctic Ocean

has not been as well explored as has its northern mate, but its region is full of interest. Three distinct points of land jut out of this great frozen sea toward the north, which are known as Wilkes Land, Enderby Land and Graham Land. These three lands form almost a triangle, with points on each side of the earth. About all that is known of them is the intense condition of cold that exists on the interior, as is found by the great currents of cold air that blow off the land. However, it is supposed that a great continent exists there, yet to be explored. The latest southern exploration was that of the "Belgic," sent out by the Belgian government. The party on this vessel was ice-bound below the seventieth parallel for eleven months, the farthest point being 71½ degrees. One important discovery made by them was that the southern magnetic pole, which governs the compass in the southern hemisphere, is some two hundred miles farther east than was formerly supposed.



ALMOST AT THE NORTH POLE.

The American flag flying from one of the series of relief and supply stations at Cape Tegetthoff.

THE PARTITION OF CHINA.

NATIONS SCRAMBLE FOR POSSESSION OF THE FLOWERY KINGDOM.

WHEN the war between China and Japan was ended and China was beaten so badly that she had to give not only cash indemnity but territory as well to her victorious opponent, the nations of Europe saw that there lay before them a country the most populous in the world, rich in its resources, and lacking force of character so much that they at once decided to grab as much of this easy prize as they could. Japan was deeded as indemnity Shashih, Suchow, Hang-Chow, the Liau-Tong peninsula, and the temporary possession of the port of Wei-Hai-Wei. Russia, France and Germany at once complained of this; Russia wishing Port Arthur, in the province of Liau-Tong, as a southern terminus of the Siberian railway. Russia got possession of Port Arthur with long leases.

Germany complained of this treatment, and a little later, rather opportunely, occurred the massacre of several German missionaries. This was used as a good pretext for demands upon China, and a seizure of ports was made by forces landed from German warships. After a dispute between the two governments, China paid a sum of $450,000 to the families of the murdered men, and gave a ninety-nine-year lease of the port of Kiao Chau and other territory seized by Germany to that nation. About this time Great Britain was fully awake to the possibilities of the situation, and began dickering for her share of the spoils. China had to have money to pay the war claims of Japan, and the only place to get it was London. Eighty million dollars were advanced to China by England, and as security the port of Wei-Hai-Wei was given over. England now controlled the gulf of Pe-chi-li and the great valley of the Yang-tse-Kiang River, with its tributaries, draining 800,000 square miles. Later France strengthened herself along the Tonquin frontier on the south; she also acquired a lease on the south coast, with large rights for railway construction. To offset this, England secured parts of Mirs Bay on the east, and Deep Bay on the west, as well as the island of Lantao.

The partition of China is yet only just begun, and with such weak forces, no general in command of her armies, and vacillating methods of government, her unique history is threatened with severe trials unless her vast hordes rise with knowledge of their power, and throw off the encroaching Europeans.

The population of China is nearly one-third of the population of the world. The population of China and India together is nearly twice that of all of the rest of the world.

The area of China is 4,218,400 square miles.

There are over three thousand letters or characters in the Chinese alphabet.

Pekin consumes 450,000 tons of rice annually.

American Expansion.

HOW THE UNITED STATES IS DOMINATING MODERN CIVILIZATION.

WHILE the United States government has not interfered in these partitions, her "sphere of influence" is not altogether wanting. Upon the signing of the Treaty of Paris, which closed the Spanish-American war, and which gave to American control the resourceful Philippine Islands and one island in the Ladrones, in the Pacific, besides the other American acquisitions, Europe at large felt that the United States were overstepping the famous Monroe Doctrine. Early in 1898 the annexation of the Hawaiian Islands had been accomplished by the United States, mainly as a war measure for protection in the Pacific Ocean. As it is now, the sun hardly sets on the American flag. Besides this great influence brought to bear on the far east through colonization and commerce with our dependencies and with pushing the war in the Philippines, we have made ourselves materially felt in Asia proper by exporting great quantities of supplies for the Trans-Siberian and Chinese Eastern railways. In Africa, as yet, we hold little other than protection over native-born American adventurers in the Boers' republics, but here also American push and energy have been felt. When Lord Kitchener was pushing into the Soudan with his new military railway, he found it necessary to

Bridge the Atbara River.

American engineers, with their usual foresight, jumped to the spot, and by promising quicker work than any competitor landed the prize. Thirty days from the time of the letting of the contract, the steel girders for the construction of the bridge were leaving the harbor of New York on their way to Africa.

But if we are pushing forward in war and in commerce, the result has not been without evil comment by many persons and nations. China, with her dread of the influence of the white man, has expressed, through Li Hung Chang, her dislike for the methods of the republic which brought forth the great Grant who was so popular with the Chinese. "Had he yet been alive," remarks Earl Li, "there would never have been this greedy expansion toward the weaker peoples' lands."

The South American republics, with whom we have always been on such friendly terms, look with fear upon what they think are mere aggressions. They now talk of binding themselves together for protection against any encroachments

further south, for with control of Cuba, which they think we will never give up, and the absolute annexation of Puerto Rico, they believe that it will not be long before the Yankees will strive still further to dominate the continent.

OUR WAR WITH SPAIN.

After the bloodshed of years on the island of Cuba, the destruction of the U. S. S. Maine by an explosion in the Havana harbor wrought the people of the United States to such fever heat that nothing could come but war with Spain. A court of inquiry was appointed by the President, and the finding was that the explosion had been caused by a submarine mine. This resulted in still greater ill-feeling between the two countries. April 21, 1898, Minister Woodford received his passports from Spain, and the next day the first prize of the war was captured, the Buena Ventura, by the United States gunboat Nashville. On the twenty-third, the President called for 125,000 volunteers, and the next day Spain issued a decree stating that a state of war existed with the United States. May 1, the celebrated battle of Manila occurred, in which Commodore, now Admiral, Dewey annihilated the Spanish Asiatic fleet, and took possession of the Philippine Islands. Campaigns were at once started in Cuba and Puerto Rico, while the Atlantic squadrons, increased by new vessels recently purchased from other countries and by ocean greyhounds pressed into the service by the government, blockaded the Cuban ports and tried to lay a net for the fleet of Cervera, which was on its way to protect the islands. July 1, the celebrated charges up the heights of El Caney and San Juan were successfully made by the American forces. The next day the Spanish attempted to re-take the heights, but were unsuccessful. American losses were: killed, officers, 23, men, 208; wounded, officers, 80, men, 1,203; missing, 81 men. July 3, Cervera's fleet attempted to run the blockade of the harbor of Santiago and was thoroughly overwhelmed, with a terrible loss of life and the capture of 1,300 prisoners, while on the American side only one man was killed. July 14, General Toral, commander of the military of Santiago Province, surrendered. July 26, M. Jules Cambon, the French Ambassador at Washington, in whose hands had been placed the affairs of Spain during the conflict, commenced negotiations for peace with the President. August 11, a protocol suspending hostilities was signed by W. R. Day, Secretary of State, and Jules Cambon, and the President issued a proclamation of temporary peace. August 13, General Merritt and Admiral Dewey, by combined attack, carried Manila by storm, and after five hours, fighting the Spanish surrendered the city, with about 7,000 prisoners. October 1, the commissioners for peace of the two governments met at Paris. December 10, the treaty of peace was signed by the representatives of the two governments. From the opening of the war till the date of signing the treaty but 233 days elapsed.

The casualties during this war were:

	Killed		Wounded	
	Officers.	Privates.	Officers.	Privates.
Cuba.....	23	237	99	1,332
Puerto Rico	...	3	4	36
Manila	...	17	10	96
Died of wounds	4	61	—	—
	27	318	113	1,464

The number of deaths by disease and accident from May 1 to September 30 was 2,565. Total of deaths during war from all causes, 2,910.

RICHES GREATER THAN KING SOLOMON'S.

KLONDIKE AND CAPE NOME GOLD DISTRICTS.
DIAMONDS OF ENORMOUS VALUE.

Klondike.

THE fall of 1897 brought great quantities of gold from Alaska and the bordering Canadian frontier, with news of still greater veins to be opened up. At once great numbers of prospectors struck out for that country, expecting a duplicate of the "days of '49." They were not disappointed, for there were found the richest of deposits all along the Yukon and Klondike rivers. However, the hardships to be endured were so great that they have turned back many prospective miners.

For many years it had been known that Alaska was rich in gold, but that such great amounts would be taken out was never dreamed. The territory that is so rich in this product lies mostly just within the Canadian lines and between our border and the 138th meridian of west longitude, and has for central point Dawson City. Circle City, with a surrounding gold-bearing region, lies further west and within the United States territory, not far from Fort Yukon, on the river of the same name. The Klondike is really only a creek tributary to the Yukon, while Lewis River, Forty Mile Creek, and Copper River are adjacent to it and bear gold. The Klondike, which names the district, was called Throchec by the Indians, which means salmon, possibly because of the great number of these fish there.

The Town of Dawson,

which was named after the man who fixed the boundary between American and Canadian possessions, is new, and is chiefly a source of supplies and a place of meeting. The site is on the east bank of the Yukon and on the north bank of the Klondike River, which empties into the Yukon at that point. The boundary line is seventy miles southwest.

The gold has been found in the small creeks that flow into the Klondike. First comes Bonanza Creek, a mile and a half back of Dawson. It is thirty miles long and very rich, but its tributaries are still better. Ten miles up it the Eldorado, for example, is the most productive streak that has been turned up; it is only six miles long, and is all staked out in claims, about $250 has been taken out in a pan, and it is estimated that the yield will be $20,000,000. Seven miles above Bonanza the Klondike receives the waters of Bear Creek, which is also rich in gold. Hunker Creek is fifteen miles up the Klondike, and up that is a little stream, about the size of a brook, which is called Gold Bottom. All these streams flow from the south, and they come from hills that must have lots of gold in them, for

other creeks that run out of them into Indian River show yellow, too. Indian River is about thirty miles south or up the Yukon from Dawson. Stewart River and Sixty Mile Creek, with their tributaries, all south, and Forty Mile Creek, with its branches, off to the northwest—all have gold. The average yearly yield of the Alaskan and Klondike mines is about $6,000,000.

The Largest Nugget

ever found in the Yukon country was brought to the surface in creek claim 34 Eldorado by Peter Gordt. It weighs six pounds, and represents $1,158 worth of gold.

Cape Nome District.

The most remarkable gold mining at present in the world, if not in the entire history of gold mining, is that now in progress at and about Cape Nome, on Norton Sound, Behring Sea, Alaska, situated about 225 miles north and west of the mouth of the Yukon River, or 135 miles from St. Michael's. Gold was first discovered on Snake River in the fall of 1898. In June, or early in July, 1899, some one of the stranded miners tenting on the beach, as the only unclaimed space, accidentally discovered gold in the sand at his feet. Never had such easy mining been heard of, never had it been found so unexpectedly and so opportunely, and it was not long before everything else was deserted for the seashore, and even women and boys of ten or twelve years were to be found as busy in the sand as the men were. At present it is estimated that 1,000 to 1,200 miners are at work on the beach, extending west for twenty miles. All these work with rockers, and they occupy just as much territory to the man or group as can work it. It is not unusual for one small square bit of beach to pan out $10 to $15 per hour, but, of course, the space is soon exhausted and the lucky digger must move to another spot.

Where Does It Come From?

This beach deposit of gold is as yet an unsolved problem. By some it is claimed that the gold in the sand, which is entirel, "dust," has been washed out from the tundra by the waves at high tide and deposited through hundreds of years in the sand.



HYDRAULIC MINING IN THE ALASKAN GOLD FIELDS.

Cripple Creek, Colorado.

Cripple Creek district is now at the height of its productive history. The rate of growth in output from month to month is greater than ever before, while the gush veins, ' near the surface, have become strong ore bodies, with well defined walls, at from 300 to 800 feet in depth, with shafts extending

to the 1,000-foot levels. The Portland Company has a gold production record of $7,000,000, with dividends to date amounting to $2,377,080. Its territory consists of over 180 acres of claims on Battle Mountain, and the whole property is splendidly and thoroughly equipped with up-to-date machinery and buildings. The output of $7,000,000 has been secured from 2½ per cent of the total acreage, leaving 97½ per cent practically untouched. The production of the mine is now being limited to $200,000 per month.

The gross value of the ore marketed from the camp in one month reached $1,731,000. Of the material shipped, the cyanide and chlorination mills treated 24,950 tons, ranging in value from $20 to $35 per ton, while the smelters handled 11,000 tons, at an estimated value of $93 per ton, a larger figure than ever before for this class of material, demonstrating a gain in gold contents as depth is attained in working the mines.

South Africa.

Gold was discovered in the Transvaal in 1886, and since that time has been taken out in vast quantities. Cities have arisen as if by magic. Railways, telegraph and cable lines have been strung, and everywhere has been felt the power of gold. In 1898, gold to the amount of $74,220,000 was taken from this region, and the limit to the veins is not yet near.

Diamonds.

Though diamonds are now found in the greatest abundance in Brazil and South America, they were formerly obtained from India, Borneo and the Ural Mountains of Russia. The great stones of history have almost without exception come from India, though recently a number of diamond monsters have been found in South Africa, of which the most noted is the Excelsior, weighing 970 carats.

Occasionally diamonds come to light in other regions. The Piedmont plateau at the southeastern base of the Appalachians, between Virginia and Georgia, has produced some ten or twelve diamonds which have varied in weight from one to three carats, to the "Dewey" diamond, which weighed over twenty-three carats.

It is, however, in the territory of the great lakes that the greatest interest now centers, for in this region a very interesting problem of origin is being worked out. No less than seven diamonds, ranging from four to twenty-four carats, have been found in the clays and gravels of this region.

In 1883, a diamond was brought to Milwaukee and sold for $1. Later it was found to be a diamond of sixteen carats' weight. The woman who found it lived in Eagle, Wis., and the stone was picked up during the excavation of a well. Ten years later a four-carat diamond was found at Oregon, Wis., by a farmer's boy at play in a clay bank. A third diamond was found at Kohlsville. Another beautiful stone of six carats was found at Saukville, Wis., and was in the possession of the finder sixteen years before he knew its value.

Probably the

Greatest Diamond Mines

of the world to-day are those in and around Kimberley, in South Africa. Diamonds were discovered here in 1870, and since then the value of the world's output has been fixed at this point. Well may the value of these mines be imagined when we learn that since their first discovery diamonds to the value of $400,000,000 have been marketed from South Africa.

COMBINATIONS OF WEALTH.

The Greatest Problem of the Age.

WHAT ARE WE TO DO WITH CORPORATIONS AND TRUSTS?

THE beginning of the industrial combinations goes back a great many years. It dates from the abandonment of the spinning wheel and the knitting needle. When women went out of the stocking-knitting and rag-carpet business, that industry was taken up by men who had machinery with which to carry it on more cheaply and more quickly. When the cotton-gin was invented the industrial combination had its beginning. When the machinery that makes boots and shoes was invented the great boot and shoe factories were made possible, and the business of the individual shoemaker was taken from his hands and put into the hands of the capitalists. When the oyster men on the Long Island shore began to turn their oysters over to the owner of a big sloop, who took them to market, they economized time and made what was in principle a business combination like what are known as the trusts. The dairy farmer sends his milk to a co-operative cheese factory, where the work which was once done on his own place is done much more cheaply and much better; and he gets a better price for his product at a smaller expenditure of labor.

These combinations are being formed everywhere. Cartwright's power loom gives employment to half a million people in the United States, and their wages are $160,000,000 a year. Whitney's cotton-gin enables us to put on the market every year two hundred and fifty million dollars' worth of cotton goods at a price which makes clothing plentiful and cheap, but still gives employment to hundreds of thousands of men at good wages and brings to capital a fair return.

The Old Hand Process

of shelling corn was so slow that it would take one-third of the whole population of the United States working every day in the year to shell the corn crop of this country, if machinery had not been invented that does the work with marvelous rapidity and cheapness. The possibilities of economy in production are enormous. Invention is the foundation of industrial combination. These combinations have not only increased enormously the productive capacity of the people, but increased the wages of labor and the certainty and steadiness of employment, and cheapened the product of labor to the consumer. It is because of these combinations that we are to-day sending enormous quantities of manufactured goods to all the countries of the world. It is not alone capital which has entered into combinations. Labor has its combinations, and they will increase in strength.

The danger which confronts industrial combination is the danger of over-capital-

ization. We have had some evidences of a disposition to over-capitalize already, and too much stress can not be laid on working against it. It should be regulated by law. This danger was more serious once than it now appears. We were threatened not long ago with a repetition of the South Sea bubble. The story of

The Trusts

has created an epidemic of desire to acquire sudden wealth. At intervals the public hears of men who have risen from comparative poverty to great riches in a short period of time, and others wish to do likewise.

Aside from the question of over-capitalization, the trust is in a large measure on trial. It was not so many years ago that there was a bitter public sentiment against corporations. Every effort was made, especially by adverse legislation, to discourage them. After a time men began to realize the benefits of the corporate form, and now recognize its advantages. The same feeling exists to-day toward great industrial combinations. It found expression recently in Missouri, in the passage of a law against the department store. In one respect

The Department Store

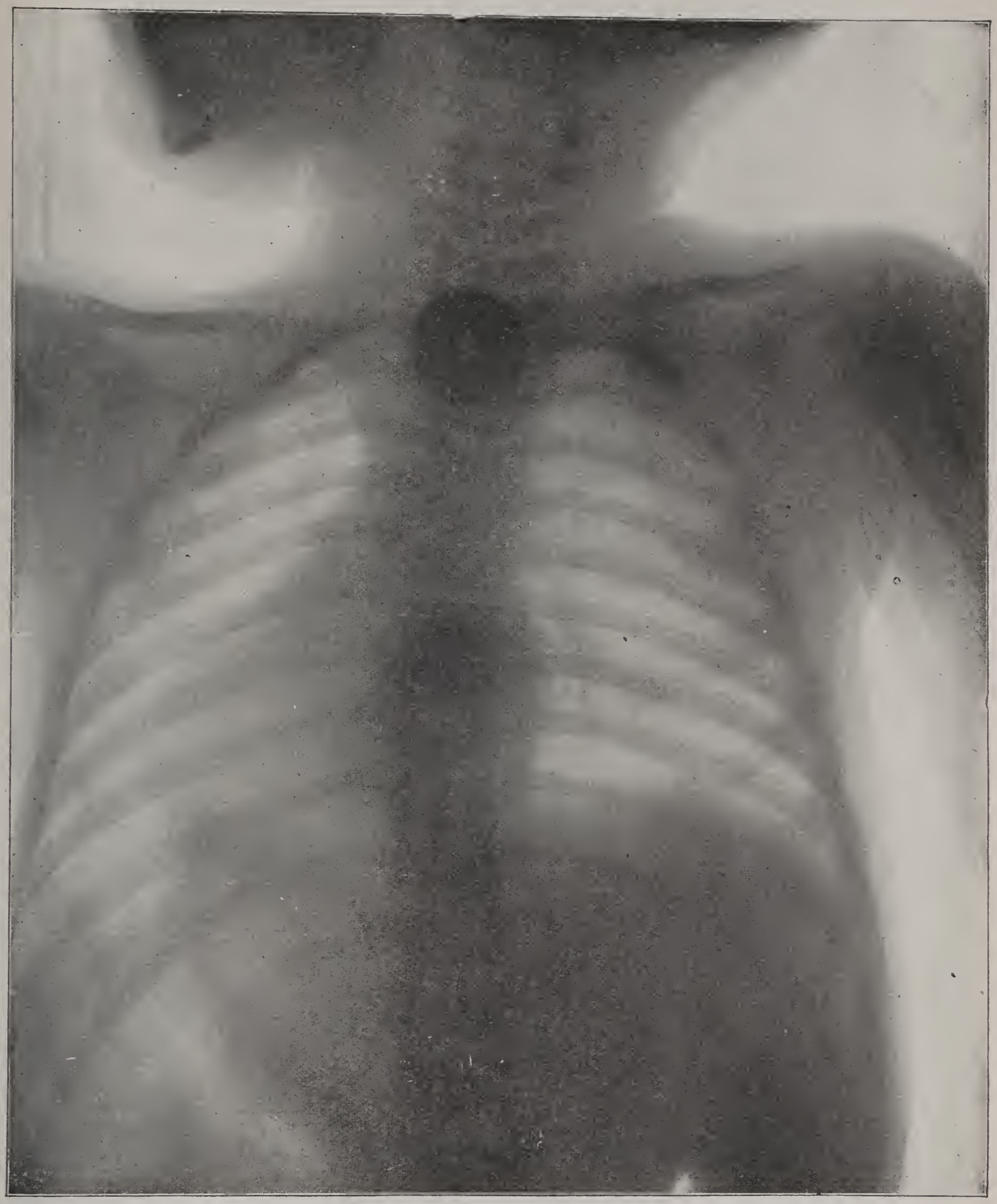
is like what we know as the trust. The man with small capital—say ten thousand dollars—is doing a business of one hundred thousand a year, and has to make at least five per cent on the gross sum to pay the expenses of his establishment and support himself. Along comes a department store and goes into competition with him. That store does a business of a million dollars a year, and can figure on a fair profit if it makes only one per cent on its gross receipts. The one-per-cent store drives all the little people out of business, and they must either move to some smaller place or quit business.

The feeling of twenty years ago against the Vanderbilts is being duplicated to-day as a result of industrial combinations. It is a hatred of the very wealthy, and a desire to deprive them of the greater part of their wealth. Whether it will find expression in stringent legislation against the trusts, no one can tell now. The American people, when they have had time to consider a matter carefully, are pretty sure to form a correct judgment about it. They sometimes act hastily and do wrong; but they are sure to come out right in the end.

The Trust is on Trial.

If it proves, like the corporation, to be inoppressive, and a necessity to the conduct of certain operations which are for the public good, it will live. If, on the other hand, it oppresses the people, they will very quickly put a stop to it. If it violates public sentiment, it cannot live—if it puts into the hands of a few men the manufacture or distribution of any article of prime necessity, so that the American people feel that they are dependent on any set of men for coal or steel or anything which is in universal use, it will die.

The Carnegie Steel Company, with its capital of $250,000,000, and the Federal Steel Company, and the American Company, are of enormous wealth and power, and each controls a large part of the trade. But they operate independently of each other, and it is possible for the other steel and iron plants also to live; hence there is little popular feeling against them. If they combined to form one gigantic corporation, and to crowd out some of the smaller though still important makers of iron and steel, they will find public opinion operating to bring about legislation to restrain them, and



THE ROENTGEN OR X-RAY SHOWING A BUTTON LODGED AT THE ENTRANCE TO THE LUNGS. SEE HOW PLAINLY THE RIBS SHOW.



X-RAY USED UPON HUMAN LEGS SHOWING THE CONFORMATION OF THE BONES: THE SEPARATION BETWEEN THEM AND THE ENVELOPMENT OF FLESH.



BIG TREE "WAWONA," MARIPOSA GROVE, CALIFORNIA

28 FEET IN DIAMETER AND 275 FEET HIGH



BRIDGE ALEXANDER III, PARIS, AND EXPOSITION BUILDINGS, 1900

eventually to break up their business, if it did not break up through the natural operation of the laws of trade.

The Whisky Trust Met Its Fate

without the intervention of the law-making power. It undertook to do so much for its stockholders that it actually made it profitable for the man of small capital to start in business; for if he could not compete with the trust he could at least sell out to it; and in time the building of distilleries to sell to the trust became a recognized industry.

It remains to be determined whether the regulation of the trusts is a matter for Congress, or, as the Attorney General holds, for the States which charter them.

South Africa and the Boers.

England's Conquest of the Transvaal.

THE clash of arms in South Africa between the forces of Great Britain and those of the two Dutch republics, the Transvaal, otherwise known as the South African Republic, and the Orange Free State, is the final outcome of a state of ill-feeling that dates back to the beginning of the century. South Africa was originally settled by the Dutch. Huguenot refugees from France followed and intermarried with the Dutch. The Boers, or Dutch Afrikanders, of to-day are, therefore, a mixed race, a fact that is shown by the names of their leaders, that of President Kruger, for example, being Dutch, and General Joubert's being French. The colonists were always restive under the control of a European government, and in 1795 threw off the allegiance to Holland.

The British Gained Control

the same year, and with the exception of the brief period from 1802 to 1806 have been supreme in Cape Colony ever since Holland renounced all claims to the Cape settlement in 1814, in consideration of the payment of $30,000,000 by England.

From the first the Boers chafed under the British rule, and when the measures abolishing slavery throughout the empire were adopted, and the Boers were compelled in 1834 to free the native Africans whom they held in slavery, their dislike for the British was intensified into bitter hatred.

The Life of the Boers

at this time was very primitive. With their herds and their slaves they wandered from one pasture land to another, like the patriarchs of the Israelites, to

whom they loved to compare themselves. The British government appropriated $6,000,000 with which to indemnify the slave-holders for their losses, but payment was made in orders on London, which the Boers were compelled to discount at ruinous rates at the Cape. In 1835-36, immediately following the liberation of the slaves, occurred what is known as the "Great Trek," or migration. About 10,000 Boers "trekked" into the wilderness north of Orange River, where they hoped to be free from British control, and at liberty to treat the natives in accordance with their inclinations. Here they maintained themselves in independence at the cost of

Continual Warfare with the Natives, until, in 1848, the British intervened to establish order, and took possession of the territory, naming it "Orange River Sovereignty." This action was taken at the solicitation of many of the inhabitants, who had grown weary of the struggles with the native tribes. The change was very distasteful, however, to a large party of the Boers, and these immediately revolted under the leadership of Pretorius. Having been defeated by the English under Sir Harry Smith, they "trekked" once more, this time into the country north of the Vaal River, where they established what became known as the

"Transvaal" Government.

After a few years, experience in control of the Orange River Sovereignty, the British reached the conclusion that it was not a desirable acquisition, and in 1852, by terms of the Sand River Convention, gave the Boers liberty to organize a government of their own. The Orange Free State was immediately established, and has maintained its independence ever since, unhampered by the English. The history of the years that follow is a record of constant warfare with the native tribes until, in 1875, threatened with extermination by an outbreak which they were unable to control, the Boers of Transvaal petitioned England to come to their assistance. England's control of the territory was the price asked, and April 12, 1877 Transvaal was annexed to Cape Colony. The danger past, the Boers repented their bargain and revolted in 1880, defeating the British in three engagements, in the last of which, the famous battle of Majuba Hill, Sir George Colley was killed. By a convention in 1881, signed at Pretoria, Mr. Gladstone's government restored independence to the Transvaal, now known as the South African Republic. It was clearly understood, however, that the Transvaal was to remain under the suzerainty of Great Britain. The Boers were not satisfied, and in 1884 negotiated a new agreement with Great Britain, known as the London Convention of 1884. By the terms of this agreement no restriction was placed on the independence of the South African Republic, except as expressed in the following statement: "The South African Republic will conclude no treaty or engagement with any state or nation other than the Orange Free State, nor with any native tribe to the eastward or westward of the Republic until the same has been approved by Her Majesty, the Queen."

The Discovery of Diamond Deposits at Kimberley in 1870, and later on of gold in 1886, in the Transvaal, wrought great changes in the condition of the South African settlements. A mighty tide of immigration set in. Railroads and cities were built, and from a position of isolation South Africa became a theater of the greatest industrial activity on the part of enterprising men from all the civilized

countries. The city of Johannesburg sprang up as by magic, and now has a population of over 100,000. The Boers classed all new-comers as

"Uitlanders"

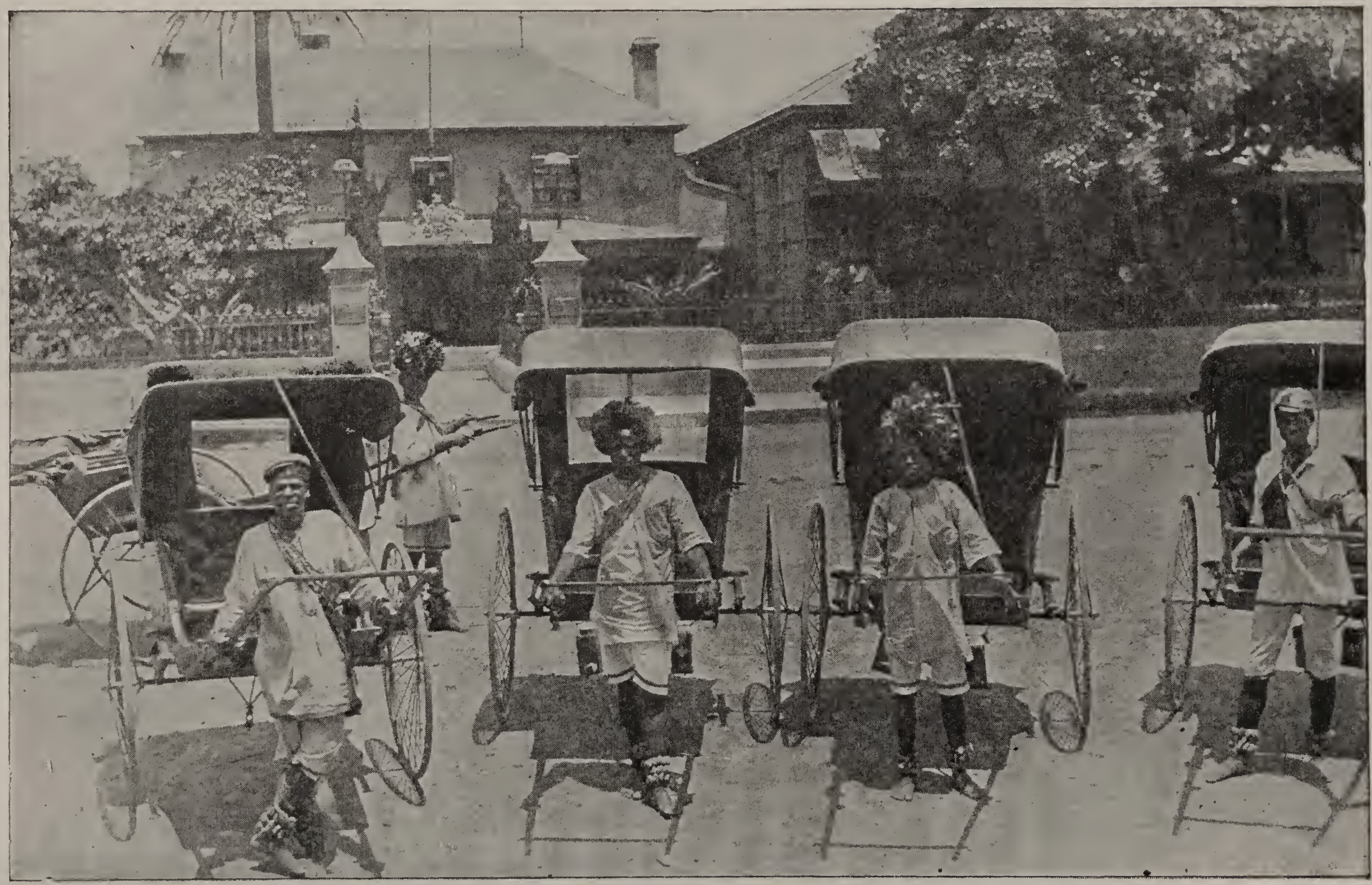
or foreigners, and viewed with alarm the rapid increase of their numbers. To-day the Uitlander population of the South African Republic is at least twice as large as that of the Boers. In order to maintain themselves in control of the government the Boers denied the Uitlanders the privilege of the ballot. They were taxed heavily, and claimed to be subjected to other abuses, of which they complained to the English. Their discontent reached a crisis in 1896, when a band of raiders under the leadership of Dr. Jameson entered the Transvaal with the purpose of intervening by force of arms in behalf of the Uitlanders. The attempt was a failure, and had the effect of intensifying the bad feeling between the English and the Boers. It was firmly believed by the Boers that the English government connived at the effort to incite rebellion, but this the British denied.

Since that time agitation has been kept up more or less constantly by the Uitlanders for the redress of their grievances. In negotiations which preceded the outbreak of the hostilities, the Boers contended that as the word "suzerainty" was deliberately left out of the London Convention of 1884,

British Suzerainty

no longer existed. This the British government refused to admit, and to emphasize its demands for reform began to concentrate troops on the border of the Transvaal. It became evident to the Boers that they would be compelled to yield or fight. They were unwilling to yield, and finally made a peremptory demand on Great Britain to withdraw her forces from the border of the Transvaal, stating that a failure to do so within forty-eight hours would be considered an act of war. The demand was refused, and the Boers immediately began hostilities in conjunction with the government of the Orange Free State, which served notice on Great Britain that it would support the South African Republic.

The division of the vast continent of Africa is really under way, and land-hungry England, always in the van of civilization and colonization, is in prospect of its own vast share. At present fourteen countries, with population aggregating 50,000,000 people, the greater majority of whom are blacks, cover a territory 2,600,000 square miles in extent, and are all under the shadow of the Union Jack. Diamonds and gold are the cause of the warfare that is ravaging the entire continent of Africa, and hardly can it be wondered at when in the last thirty years diamonds to the value of $400,000,000, and gold in 1898 to the amount of $74,213,953, were taken from South Africa alone. Foreigners with push and enterprise are populating and improving the country, and wish the Boers to do likewise. The Dutch, however, are a rather unprogressive lot, standing in the way of further encroachment this time with armed forces, which, it is likely, will eventually have to give way to the progress of Great Britain.



THE FAMOUS RICKSHA BOYS OF DURBAN, SOUTH AFRICA

THESE VEHICLES ARE USED PRINCIPALLY BY BUSINESS MEN IN GOING TO DIFFERENT PARTS OF THE CITY. ALL THE BOYS ARE ZULUS AND WEAR BEADS AROUND THEIR ANKLES CONTAINING SMALL STONES WHICH RATTLE WHILE THE BOYS ARE IN MOTION

How Glass Is Made.

Testing the Puddle—Extraordinary Heat Required—Workmen Must Have Great Endurance—Cooling the Mold—Making the Thermometer—Casting a Lens.

OF all forms of glass making that of casting and finishing the great lenses to be used in telescopes and microscopes is perhaps the most interesting and certainly is the most difficult and exacting of manufacture. The minerals from which glass is made were formerly mostly what scientists call silicates, such as potassium, lead, soda and lime, but now have been added to these ingredients phosphorus, magnesium, tin, iron, bismuth and numerous other elements. In making a huge lens the proper formula of ingredients is mixed and heated for weeks in huge yellow porcelain crucibles, specially prepared for the occasion, and which with one baking have served their purpose and are thrown into the scrap heap. Within the walls of a great furnace the terrific heat of days and days finally brings the molten mass to the proper consistency, and after it has been tested repeatedly through the "glory" hole,—about as big as a man's head—the large iron mold that is soon to receive it is brought up between the heating furnace and another furnace known as the "cooler," ready for the pouring.



CASTING A GREAT LENS IN A GLASS FACTORY, THE HOT METAL POURING INTO THE MOLD.

Testing the Puddle.

The master tests repeatedly the glass through the hole and sees by the "stirring paddle" that it is just right. Then he dusts the inside of the iron mold with a quantity of fine

sand, that the glass may not absorb any impurities from the iron. On a signal a number of workmen begin to tear down the wall of the furnace and others bring forward a huge pair of tongs set on wheels, which will soon be attached to the glowing crucible within and drag it forth. When the wall is all down the tongs are shoved forward and fitted under a ring that encircles the middle of the crucible. At the other end of the tongs, averting their faces to avoid the intense heat, the workmen bear down to lift the crucible, lever-like, from the floor of the furnace, but it is stuck fast by the overflow of glass. Very carefully they bear down harder, and finally the fervid mass is wheeled out into the casting room. Here, lest it lose too much of its heat before the pouring, a mat of asbestos is thrown over it. Now the grappling irons are changed so that a pressure of a hilting bar will overturn the crucible. At the word from the master workman the men bear down and gently, without hiss or noise, the fiery mass flows out into the mold.



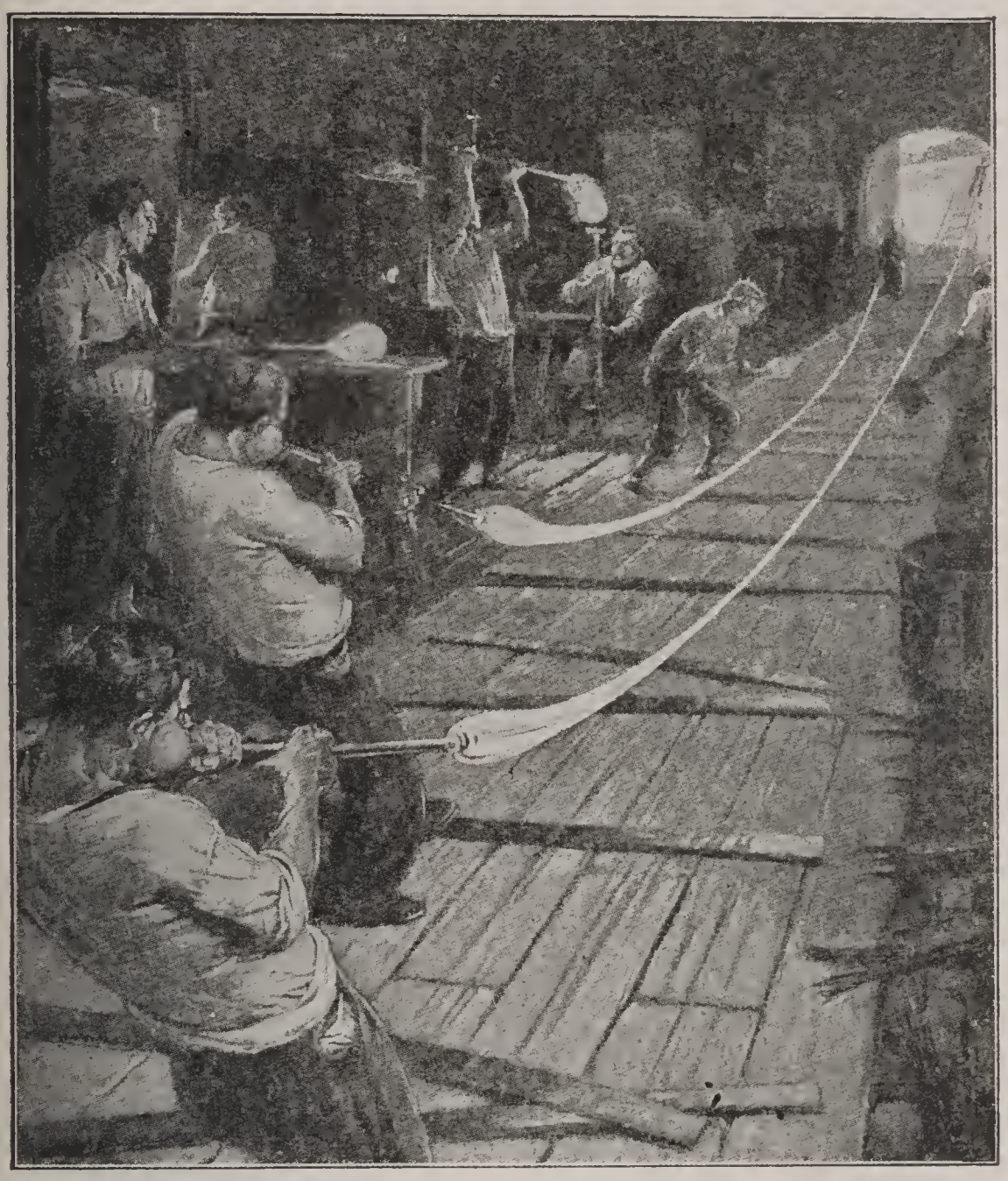
GLASSMAKERS BLOWING BOTTLES, CHIMNEYS AND OTHER GLASSWARE. A FURNACE SCENE.

Cooling the Mold.

Now the mold is covered with an iron lid and taken by a crane and lifted to a little portable tramway upon which it runs into the cooling furnace. Here for several weeks the glass gradually gives up its heat and at last emerges after a week or two, a gray mass which resembles nothing like a lens, but rather a mass of sanded glass. This must now be polished for some time until it is clear,—not to be used yet for science, but simply for a test. If no flaws are found the lens is sent back to heat for several weeks and to perfectly anneal. After that it cools gradually for about two months, and then is ready for the lens polishers. The bare glass for such a lens is worth $5,000. The additional work of the lens polisher brings the price of a large lens to about $25,000.

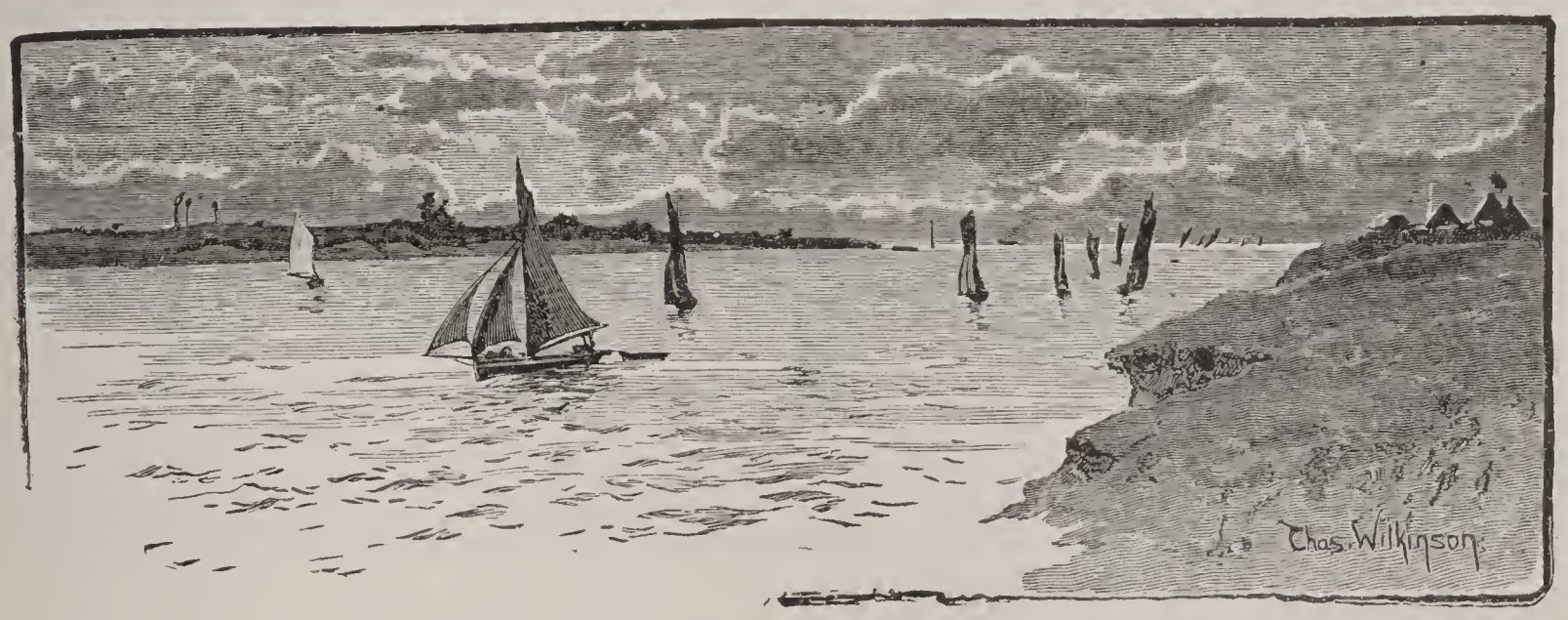
There are hundreds of other kinds of glass manufactured, each with something of a different process. In making fine thermometer tubes a very interesting method is employed. Inside a long cor-

ridor are furnaces for heating the raw materials into glass. When the right mixture is found a boy workman picks up a large blow pipe and jabbing it into the molten mass attaches a lump of it on the end of his pipe. This he blows and twirls until it assumes the shape of an acorn about the size of an orange. He now adds a little more glass, and then turns it over to a brawny workman who blows it and rolls it on an iron kneading board and then adds more glass.



BLOWING GLASS FOR THERMOMETER TUBES.

Another workman quickly attaches the end of another pipe to the mass and both men start to run backwards away from each other down the corridor, all the while blowing as if their cheeks would burst. In a few moments they have a thin tube as small as a little finger and some three hundred feet long lying on the floor of the corridor. This cools rapidly, and is then broken up into short lengths to go into barometers and thermometers and to be used for other scientific work.



THE SAULT STE. MARIE.

A Great Canal of Commerce—Building of the Locks—Annual Traffic Enormous—United States Controls.

EARLY in the first quarter of the century the people of the State of Michigan began to realize what enormous interests were bound up in the problem of constructing a serviceable canal at Sault Ste. Marie, or Saint Mary's Falls, commonly known as the "Soo." As the connecting link between Lakes Superior and Huron this narrow ribbon of surging water practically controlled the lake traffic of the great northwest. Freight rates on the railroads had always been higher than by the water, and, since the cost of shipping is about three-quarters of a mill a ton for each mile traversed by water compared to three mills per ton by rail, the vast saving to the great grain and ore producing west can readily be seen.

In the earliest history of the west the



THE CHANNEL OF THE "SOO" CANAL.

Thirty-eight feet deep, carrying 18,000,000 tons of commerce annually.



EMPEROR'S PALACE, BERLIN



FENCING EXERCISE IN GIRL'S GYMNASIUM

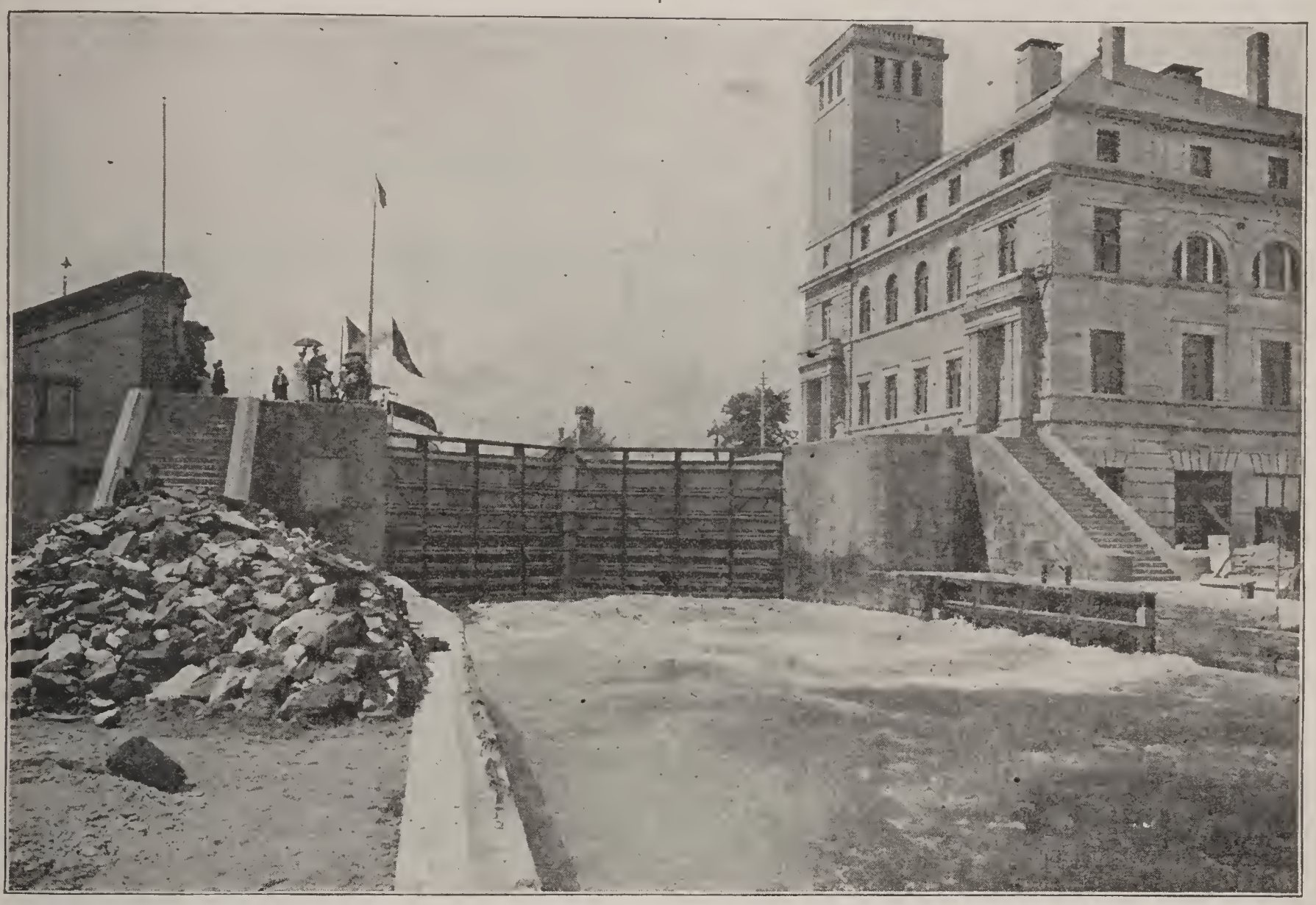


THE CHICAGO STOCK EXCHANGE WHERE THE STOCKS OF THE PRINCIPAL TRUSTS OF THE UNITED STATES ARE SOLD. SCENE DURING INTERMISSION.



THE MINNEAPOLIS BOARD OF TRADE. SCENE AT THE GRAIN SAMPLE TABLE.

settlers saw that an advantage was to be had by building a canal at this point, and accordingly they constructed a meager set of locks by which the fur-carrying canoes of the traders might be let down the nine-foot incline. After Michigan took up the matter Congress was petitioned and a grant of 750,000 acres of land was made for the purpose of establishing a suitable canal service. Work was begun on the canal, and so greatly had the lake traffic expanded that the locks when completed by the State were four times as large as at first contemplated. This system was seen to be inadequate, and the federal government was asked to assume charge of the future work, and did so in 1870.



LOCK HOUSE AND HEAD OF THE "SOO" CANAL.

National Control.

The control by the United States has resulted in the building of two magnificent locks, one of them the largest in the world,—and both operated absolutely free of cost to vessel interests. The smaller lock, which cost $2,500,000, is over 500 feet long and 85 feet wide. The larger measures a little over 800 feet in length, and is 100 feet wide. It cost over $5,000,000, but so effective is the construction that four mammoth lake steamers can lock through it together. Both locks let vessels down an incline of eighteen feet. Just opposite these two and on Canadian soil the Canadian government has built a lock similar to and almost as large as the larger of the American locks. The "Soo" is constructed of stone and concrete with mammoth metal gates. When the locks are to be used by vessels water is let in through numerous pipes which need scores of men to operate them.

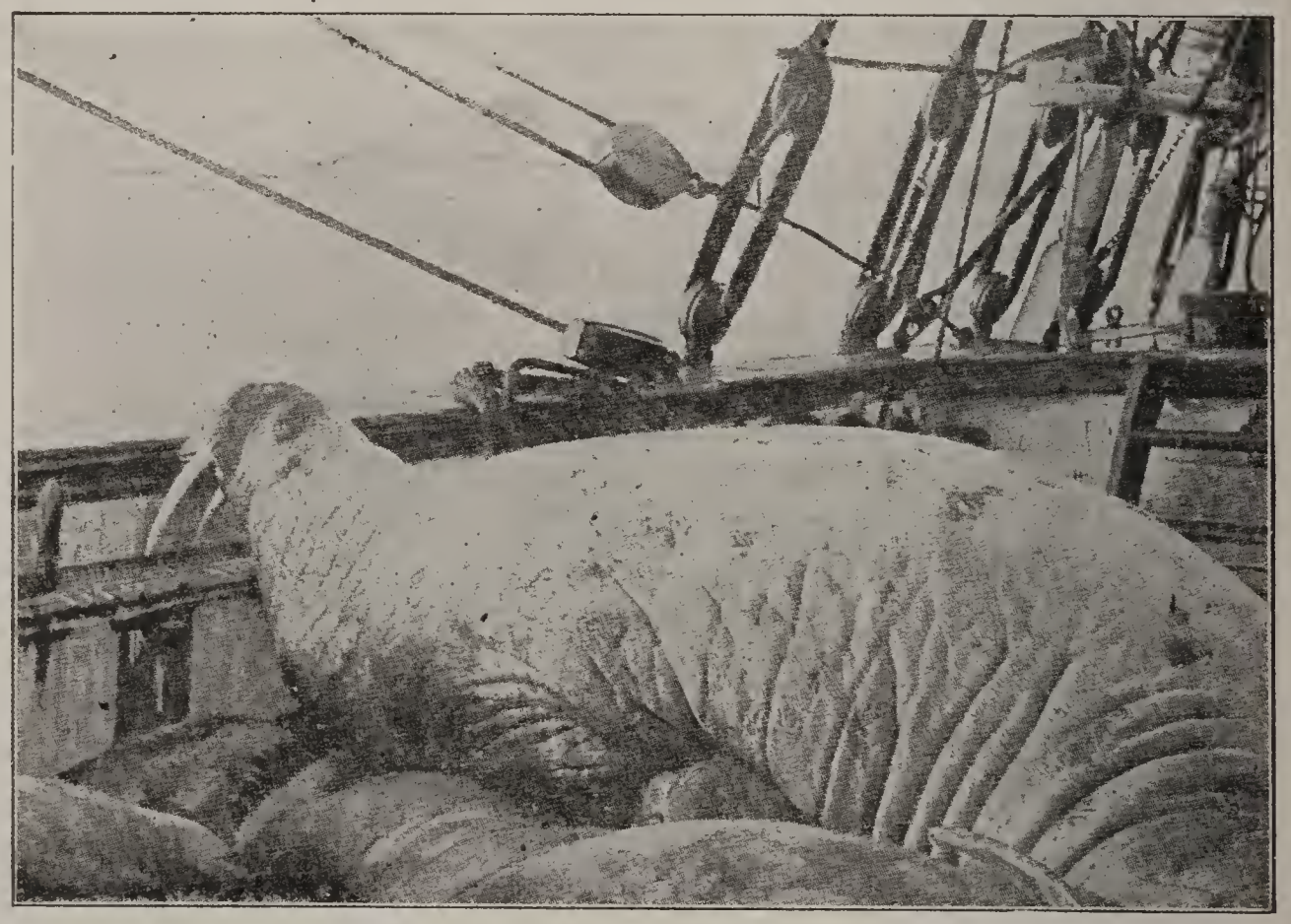
The magnitude of the traffic that annually goes through this waterway surpasses that of the Suez canal. Freight rates on America's inland seas are the cheapest of any in the world; besides the natural position of the "Soo" is that of the gateway for all the northwest. Coal to the value of $10,000,000 is annually carried through these locks, as is also flour worth $35,000,000, wheat worth $50,000,000, $30,000,000 in copper, $35,000,000 worth of iron ore, and lumber to the value of $12,000,000. The total value of products carried through this waterway is estimated at $240,000,000, while the cost of carriage is only $8,000,000.

HUNTING THE WALRUS.

Great Danger to Life in the Sport—Use of the Harpoon—Winchester Rifles Employed—The Animal Tries to Escape.

A VERY profitable yet dangerous enterprise is carried on by Eskimos in the Arctic seas. It is walrus hunting. In hunting the walrus according to the Eskimo style, a whaleboat is used. Usually six or eight of these little men man a stout whaleboat which is let down from a larger craft in which they are making a cruise. The implements used in the capture of the walrus are a harpoon, several yards of stout rope, and a Winchester rifle.

The animal is sighted and the whaleboat lowered to make the attack. When the hunters come within from five to twenty yards of their prey the harpoon is thrown. If the shot is true the harpoon penetrates the skin of the animal and sinks several inches through the blubber and flesh. Once inside the walrus the handle of the harpoon becomes loose and the barb or head sticks in the animal. A line is attached to this barb so that the harpoon head takes a position horizontal to the cut. Thus fastened, it is impos-



THE MODERN WALRUS.
After capture and on shipboard. Weight, 1,800 pounds.

sible for the animal to get away unless the rope breaks.

The animal then tries to escape by swimming. The gun is brought into play at this stage of the game. It often takes six or seven shots before the animal is killed. His carcass is then drawn to the boat until a lance thrust can be made at the vital parts behind the flipper, near the heart and lungs. According to the Eskimos, a walrus shot on the ice will not be killed, as a single shot is insufficient. The dead animal is then towed to the vessel, where he is hoisted by means of pulleys to the deck and quickly disposed of.

BUILDING OF SHIPS.

England Leads all Countries—Steel Ships Are in Demand—Method of Construction—Ships for Use in War—Wonderful Progress in Designs.

ENGLAND leads the world in ship building and in the shipping industry. Previous to 1860, when metal ships began to gain the supremacy over wooden vessels, England possessed what might be called a monopoly in this branch of work, but soon after the inception of steel ships a change gradually took place. Germany, which had placed all her orders for ships in English yards, in 1865 commenced the establishment of a ship-building industry that in 1900 stands before that of any other continental country in Europe. Stettin is the German town containing the ship yards where the "Deutschland," the fastest of ocean greyhounds, was built. America, too, has made great strides in ship building since 1888, which year also marks the time when Germany struck out along lines of independent progress.

Between the years of 1860 and 1888 both Germany and America were placed at a disadvantage because neither of these countries could produce iron as cheaply as England. So rapid has been the development of the United States in the ability to mine and prepare iron and steel that experts of authority say this country will surpass Great Britain as a producer of ships before many years have gone by. England owns over 7,310,000 tons of steam merchant marine, which has an annual earning capacity of $500,000,000. The sailing fleet of our cousins across the water brings into the realm of Queen Victoria $130,000,000 every year. Perhaps a clearer understanding of England's position as a sea power can be obtained when it is stated that 56.6 of the world's merchant marine carrying capacity is done by the ships flying the Union Jack.

Some idea of the magnitude of the work necessary in the construction of a great ship can be grasped when it is understood that it is more than a year from the time that the keel of the "Deutschland" was made that the hull of the big liner was ready to be launched. A force of thirty draughtsmen worked on the drawings for this steamer before a stroke of the hammer was heard in the yards of Stettin.

For one year after 1,500 skilled workmen put their entire time on the strips and sheets of steel which finally were united in the form of a ship. The total cost of the "Deutschland" was $3,000,000. Her speed is about twenty-six miles an hour, which is remarkably fast when it is remembered that this rate is frequently maintained for a day at a time. The length of the "Deutschland" is 686½ feet over all; the beam 67 feet, and the depth 44 feet. In displacement this ship registers 16,500 tons, nearly 6,000 tons more than that of either the "St. Paul" or the "St. Louis," the largest liners ever built in the United States.

War Ships.

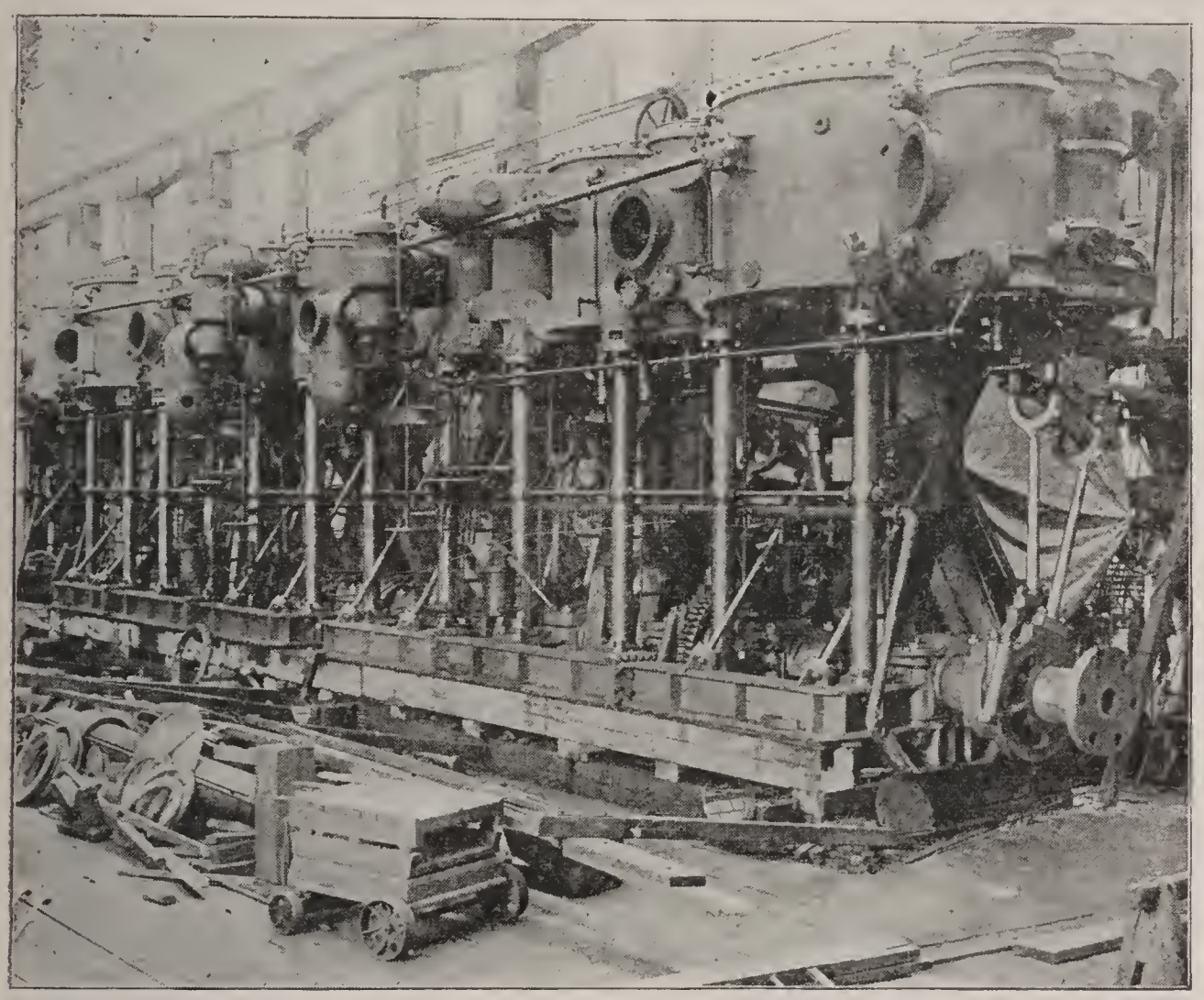
War ships differ in appearance from ocean liners in that they usually have more beam or breadth, and are, for the most part, not much over half as long. This is because the liners are built primarily for speed. The two battleships, "Alabama" and the "Kearsarge," the newest additions to the American navy, were completed and launched in September, 1900. The money spent for the con-



SCENE IN CRAMP'S SHIP-BUILDING YARDS AT PHILADELPHIA.

With two vessels about to be launched. Ships are launched when their keels and hulls are completed.

struction of these fighting machines was something over $11,000,000, which, as is seen, amounts to nearly double the sum which would be required to build two ships of the class of the "Deutschland." Both the "Kearsarge" and the "Alabama" are 368 feet long on the water line, and have 72 feet beams. Their displacement is 11,525 tons, and they speed about nineteen miles an hour. As these two battleships are considered the best afloat, it will be perceived that so far as quality of workmanship is concerned the United States ship builders need fear no competitors.



THE DOUBLE-COMPOUND MAIN DRIVING ENGINES OF THE BATTLESHIP OREGON.

And which brought her from San Francisco to Cuba without accident or delay.

In case a ship fails to make the speed required in the contract, the builders have to pay a penalty of about $100.000 for every mile and an eighth below the total number of miles which the boat is supposed to make inside the hour limit.

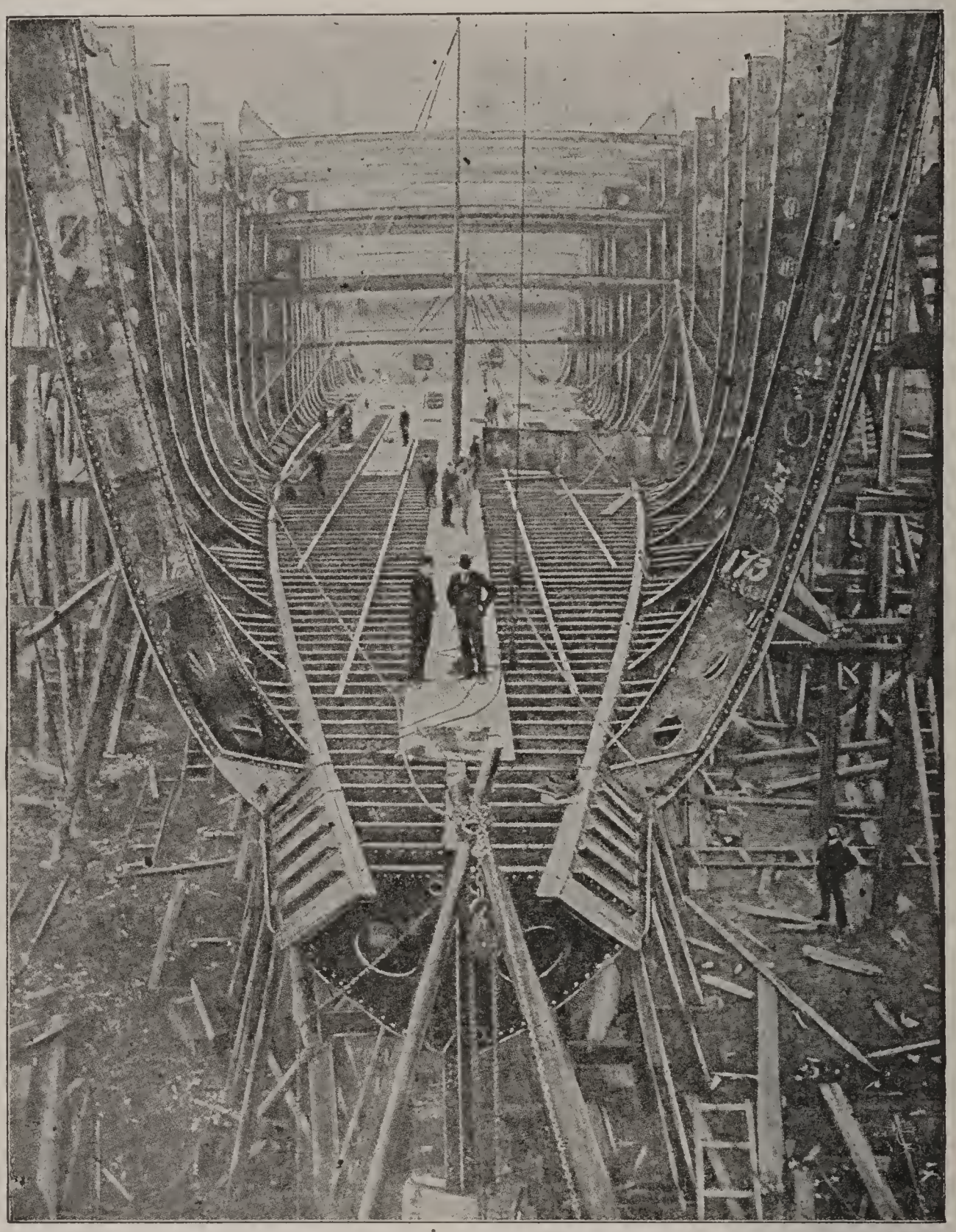
There are two distinct portions of ship building: the theoretical, known as naval architecture; and the practical, called ship building. Every ship must possess certain qualities, the chief of which are buoyancy, stability, speed and handiness. At the same time the nicety of relationship among these requisites must be maintained, as, to some extent, they neutralize one another. Here is where the skill of the naval architect must appear.

In some vessels the greatest possible speed must be attained. An increase of length gives an added displacement of water, and consequently enlarges the carrying power. If this is not the prime desirability finer lines are permitted for and aft, and the speed of the ship is heightened. Increasing the breadth of the beam gives to the ship more stability. Three plans are made by the naval architect. The sheer plan shows all the lines of the length and height; the half-breadth plan indicates the lines of the breadth and height, and the body plan reveals the breadth and height.

How Constructed.

Steel, which is most largely used by ship builders of the nineteenth century is as much superior to iron as is iron to wood. The laying of the lines of the ves-

sel is the first step in construction. The keel, made up of several thicknesses of steel, scarped at the ends and riveted together, is placed in position. In the middle or the keel a center plate, which later is carried upward and through the floor of the deck, forms a keelson. On either side of this is a thick bar, and outside all these are put the two lowermost plates of what is known as the "skin," bent downwards. The ribs, in a steel or an iron ship, are termed frames. They are first heated until white, and then bent to the requisite curve. Before fully cooled they are put in place on the keel by a score of workmen with the aid of the riveting machine. To the frames are fastened the floors of the ship. These are narrow plates running across the vessel. Then the beams, which support the decks, are thrown into position and the form of a boat begins to make its appearance.

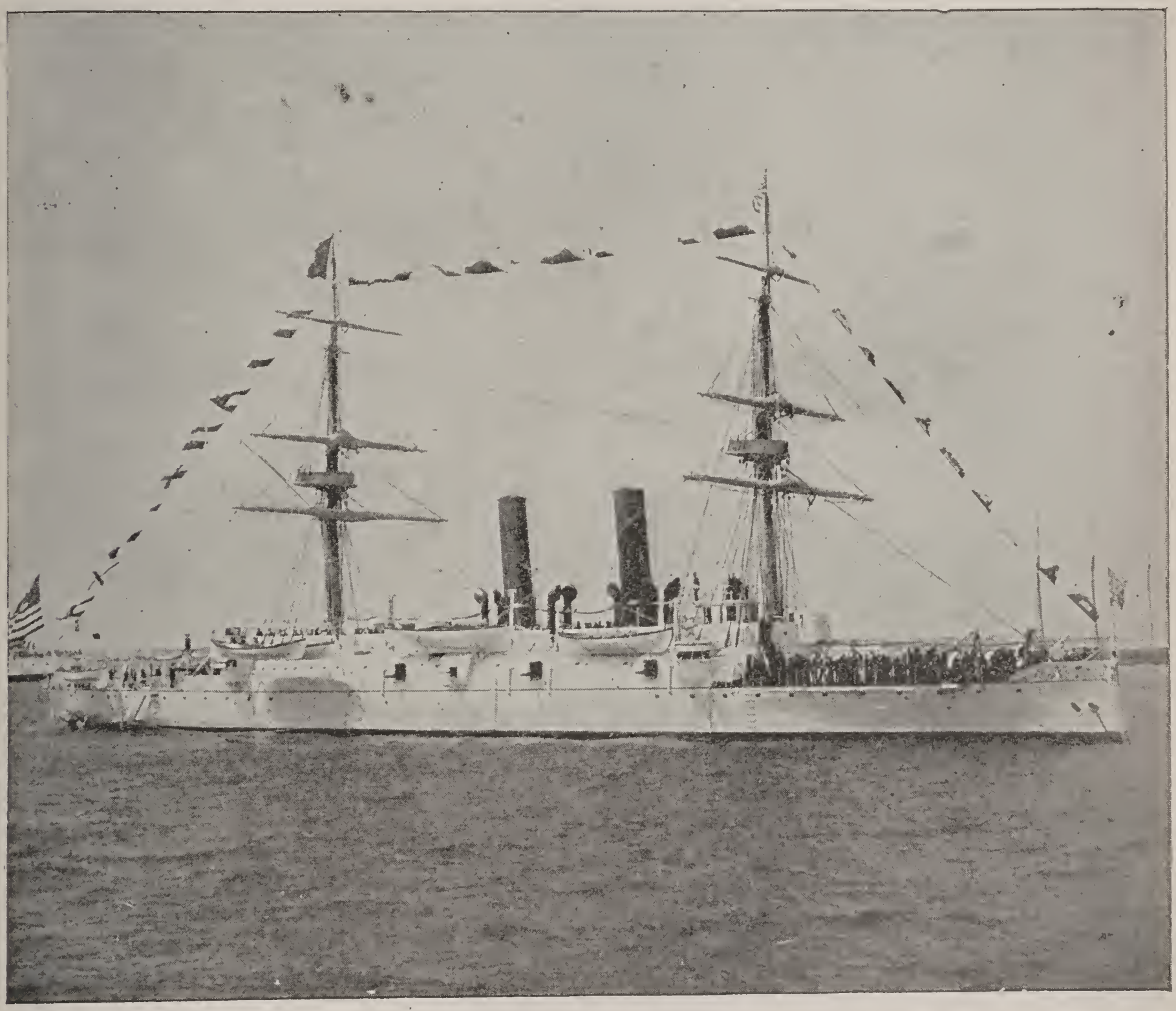


THE IRON RIBS AND KEEL OF A MODERN MAN-OF-WAR IN A SHIP-BUILDING YARD,

After the frames, beams and floors are finished, the putting on of the heavy outer plates commences. When this is at length completed the deck beams are further secured and stiffened by longitudinal and diagonal plates called stringers. No vessel built since 1890 is without the safety appliances which are now considered indispensable. For example, a false bottom, constructed seven or eight feet above the real bottom of the vessel makes the striking of a rock at sea a danger by no means so formidable as in the early days when such a means for protection was unknown. Compartments, so built that the ship can be divided up into twenty-six or more sections, also contribute to the safety of the thousand and more passengers who are housed in an ocean greyhound during a voyage. In

case a fire should break out in any part of the ship, by closing in that particular part of the boat the spreading of the conflagration can invariably be prevented.

The bulkheads, in addition to furnishing the water-tight safety compartments, also lend greater transverse strength to the ship. By the time the external plating is finished it is time for the launching but much yet remains to be done. The greater part of the decks has to be laid; the whole of cabin fittings needs to be put up; the rudder and steering gear require adjusting; the wooden ceiling, which lines the hold, has to be constructed; the masts have to be set, and the rigging strung, and finally the massive engines and the ponderous boilers lowered into the hold and made secure against the pitching and tossing of the ship. With the encouragement given to American ship building since 1898 it is openly predicted that before 1920 no market in the world will have an equal amount of work to do; and when this time arrives England will be forced from the position which she has so long maintained in the shipping industry.



MODERN MAN-OF-WAR

GREAT ARMOR PLATE

America Produces the Best Steel—Crude Iron Ore Used—What Steel Is The Molding Process—Thickness of Plate.

AMERICA enjoys the distinction of producing the best steel in the world, and in such quantities is it sold abroad that other countries are becoming jealous of her prowess. One of the most wonderful processes in the realm of steel working is that which converts from the crude iron ore just from the mines the monster hundred-ton plates of steel two feet thick, destined to adorn and protect the sides of the great war vessels of the world from the angry missiles of a foe.

When one considers that in 1895 we exported to Great Britain but fifty-nine tons of unwrought steel, and that in 1898 30,000 tons were shipped to that mart, it may be seen how the American industry has grown. At south Bethlehem, Pa., is operated one of the best and greatest plants in the world for producing almost impenetrable armor plate. Here daily are operated engines of science that wield masses of metal of such enormous weight and exert forces of such tremendous power that it would seem that all the giants of mythology were imprisoned here doing the bidding of the quiet men who conduct them. A glance at the method in operation at this plant may be instructive.

What Steel Is.

Steel is the result of a combination of pure iron and carbon. (See article on steel rails.) After the process of blasting has removed all the impurities from the iron, and it is run off into the sand floor to cool into "pigs," some particular system is used to model the huge white-heated ingots into their desired shapes. For tools the system is called the crucible process; in making steel rails the Bessemer process is the one most employed, while in making heavy sheet and plate the open hearth method comes into the foreground.

This last method is employed principally because of the intense heat generated. By it no other enclosure for the pig iron and the other ingredients is needed than the furnace walls. After the iron ore has been reduced to pigs it is

carried, often while still hot, to the open hearths, where mixed with its proper quantity of carbon, generally in the form of scrap steel, it is treated to a heat of 4,000 degrees Fahrenheit. The manner of producing this heat is unique. Coal having been treated to a great heat in air-tight ovens with but a limited supply of air gives of an intensely hot gas. This gas is passed through firebrick passages that open over the hearth where the iron and steel are awaiting it. Here a full supply of air greets it and it bursts into flame. The combustion produces a terrific heat, and quickly converts the iron and scraps into flaming steel, with heat thrown off from it seemingly as great as that from the sun.

To carry off the spare gas and hot air another firebrick passage is arranged opposite the one which originally conducted the gas to the hearth. The escape of such an amount of intense heat of course warms up the escape passage to a rather tropical condition. Every twenty minutes to save heat these passages are



THE GUN-TURNING ROOM OF THE UNITED STATES GOVERNMENT AT WASHINGTON.
Where the final touches are being put on the nation's defenders.

reversed and the gas generated in the ovens is now brought out to the hearth through the already heated passage that a few moments took away the escaping heat. This method saves a great amount of heat, and is one of the great principles of open hearth heating. At the Bethlehem works there are eight of these great heating hearths, four capable of accommodating forty tons of metal each, and the other four twenty tons each.

Molding Process.

After the heating has gone far enough the steel is run off into huge caldrons running on rails, and is thence ladled off into molds that also run along tracks. The method of pouring into these molds is peculiar in that it does not splash the steel, but rather gently runs it into a side tube which allows the mold to fill up slowly from the bottom. This "bottom filling" process does away almost entirely with the uneven qualities of steel produced by old methods. As a further guard against bubbles and escaping gas and air the inner sides of the molds are constructed with a kind of metal lathwork covered with sand, which allows the escape from the hardening steel without marring its grain. The process of hardening differs from the old style hammering, for such a method is likely to create flaws. The process used at Bethlehem is what is known as "fluid compression," which by hydraulic presses exerts a pressure of seven thousand tons while the metal is still in molten form. These tremendous ingots from which immense guns or crank-shafts for steamships are made often weigh as much as 120 tons, and take days to cool off.

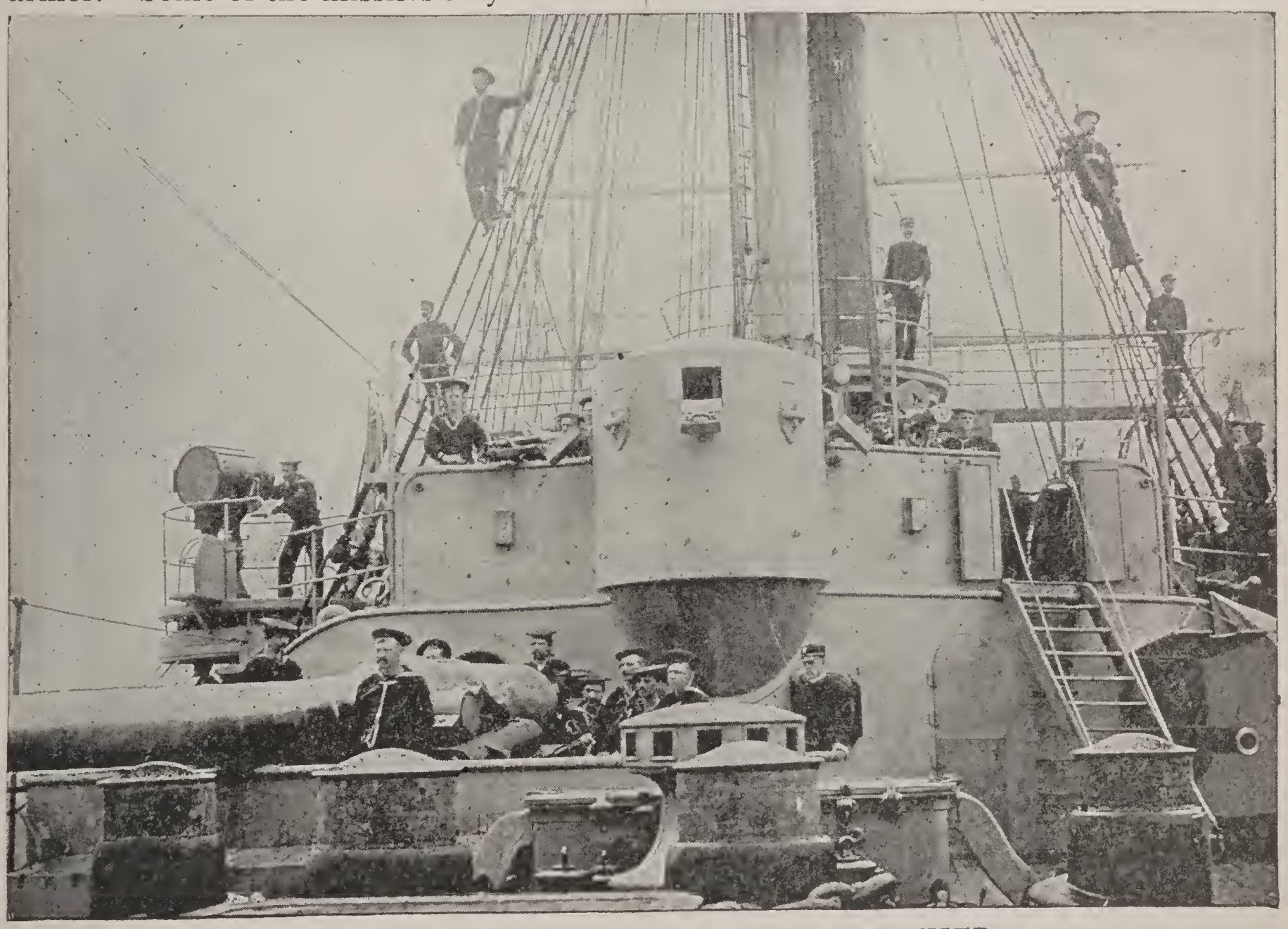
After an ingot has cooled off sufficiently to handle, the great traveling cranes pick it up and take it to a furnace where it is heated over again to a temperature of 1,200 to 1,500 degrees. The ingot is here likely to crack if not reheated just in the proper manner, so great care must be used in its handling. The enormous cranes that carry it about weigh themselves something like 175 tons each, and the engine that operates them exerts the power of 1,500 horses. After the reheating process the ingot is again treated to the hydraulic press for shaping, but this time the pressure is that of 28,000,000 pounds. This method of tempering is vastly better than the old hammer method, for formerly when great castings were manipulated by hammering, the effect of the pressure would not be felt far enough below the surface, and only the case would be hardened sufficiently to withstand the strain on it from usage as armor plating, gun barrels, or crankshafts.

Preventing Cracks.

To prevent any cracks or inequalities, therefore, in the steel, the reheating and hydraulic pressing process is repeated several times, and at last a final heat treatment called annealing may be given, or in the case of a crank-shaft it may suddenly be dropped into a tank of oil, which prevents crystalizing, and is called oil tempering. One would think that after this last treatment of tempering the steel would be rather unwieldy for trimming or paring into shape, but science has overcome these great difficulties, and great buzz saws eighty-four inches in diameter and with seventy-six inserted teeth can saw in two a plate thirty-three feet long and two feet thick. Lathes are also employed that will take a great blank of steel destined to become one of the navy's big guns and pare it and shave it down to its proper size. In making armor plates after the tempering has

gone on to a certain degree the plates are hustled over to great hydraulic presses that straighten them out and prevent warping Others are taken to other presses that exert a tremendous pressure, and bend them up into shape to fit the vessel for which they are intended.

After the plates have been finished they must be tested to see that they are suitable for service in the navy. All the time the operation has been going on, government officers have been examining the process and the material. Now they select what they believe to be the poorest specimen produced and take it to the testing ground for a practical test. It is propped up with timbers, and at a certain distance from it cannons are placed which fire point blank their charges of steel balls into the new armor. Some of the missiles only scratch the plate, others dent it, and still others go clear through. If the plate is worthy of use and stands the test, the whole batch that has been made is received by the government. If not the next poorest plate is subjected to the test, and if it meets a like fate the whole batch is condemned, the cost of the manufacture is met by the contractor, and a new set must be made. The styles of armor plate most successful have been those invented by Harvey and Krupp, though the latter is now ahead in protective qualities. Its surface, strange to say, is full of little cracks and seams, but the makers and government experts know that beneath lies a strength almost impenetrable, and dare not tamper with it beyond giving the simple coat of paint that adorns the ships of the world's navies.



SECTION OF ARMOR PLATED U. S. CRUISER

TEA GROWING

Can be Raised in the United States—Difficulties to be Overcome—Cost of Home Labor—Tea Farming in South Carolina

THERE is but one tea plantation in the United States. That is at Summerville, S. C., and it is the property of Dr. Charles U. Shepard. Here has been demonstrated the fact that it is possible and practicable to raise tea leaf in this country. According to Dr. Shepard, the cultivation of the tea plant, with a little economy, can be made a profitable industry, and he predicts that in time the United States will no longer be dependent upon the Orient for the means wherewith to make one of the most common American drinks. This tea plantation was first tried merely as an experiment. Seed was brought from the famous tea gardens of China and Japan. The authorities at Washington heard of the efforts to introduce the plant, and a commissioner was sent to investigate the matter. He made a favorable report. Dr. Shepard claims that his plants produce more leaves annually than do those in either of the countries from which the seed was brought. The products of the garden have always found a ready sale and command prices equal to that demanded for excellent brands of Oriental tea.

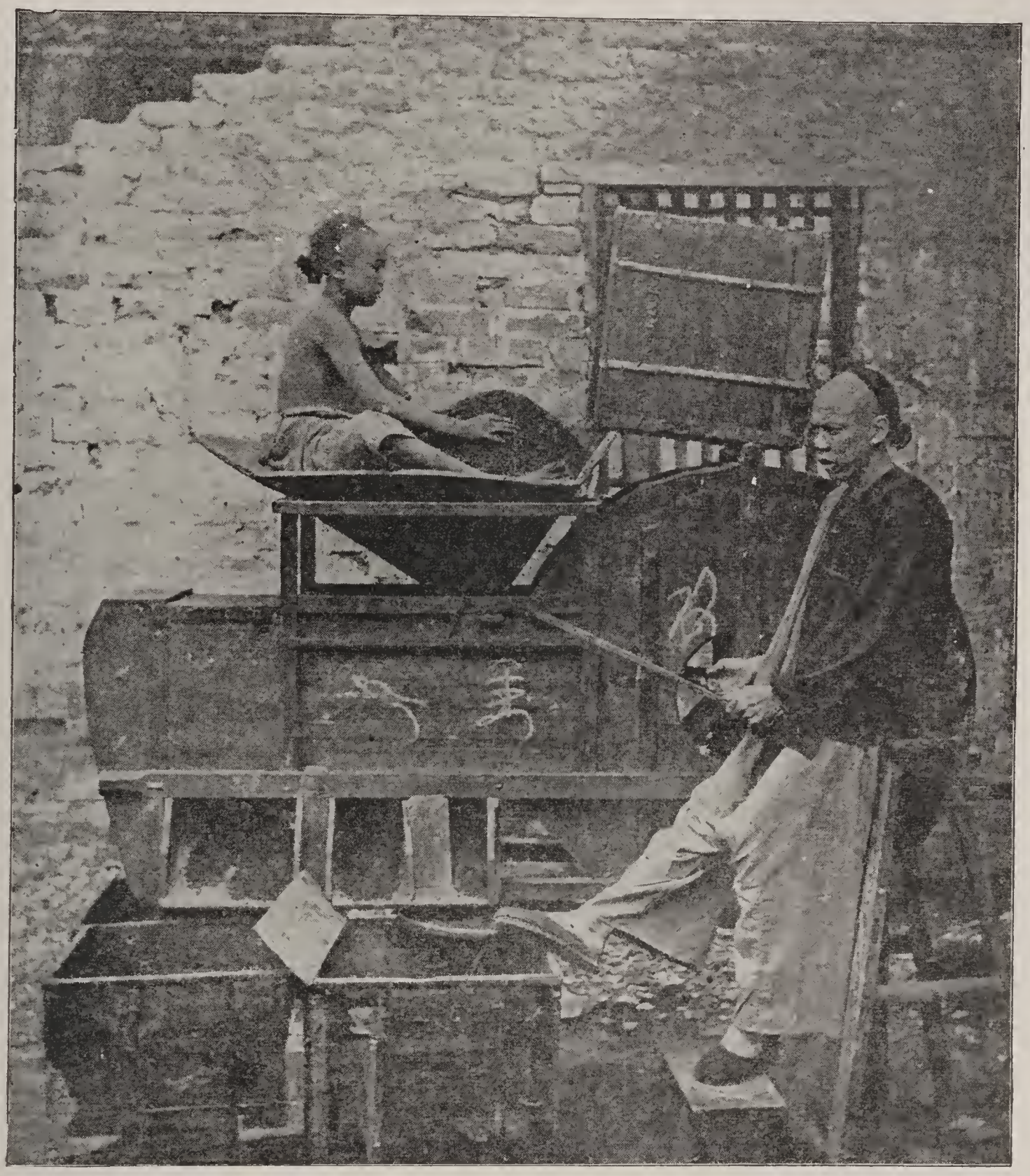
The crop in 1899 amounted to eleven hundred pounds, but much more is ex-



TEA PICKERS OF CEYLON.

Working on the plantation gathering the green leaves for drying and preparation.

pected of future seasons. The most important things to be considered in growing the plant in this country are the price of labor and the yield per plant. In America it costs as much per pound almost to pick the fresh leaf, owing to expensive labor, as it does in the Orient for the raising, picking and packing of the same amount. The problems facing the American tea planter are two: he must either cultivate a much better brand than that imported, or he must materially reduce the expense of labor. In fitting out a plantation a well-equipped factory is indispensable. The leaves must be spread out to dry, rolled, and be oxidized; all of which require machinery and space. The total cost of maintaining a factory capable of producing fifty pounds of dried tea daily may be estimated from fifteen hundred to two thousand dollars annually.



CHINESE WINNOWING TEA.

Somewhat like our old method of fanning wheat, with the exception of the youthful feeder.

THE WORLD'S WHEAT.

The Cry for Bread—Annual Wheat Supply—One Barrel of Flour for Each Human—Danger of Lack of Supply—When Wheat Ripens.

EUROPE feeds off America, and off wheat at that, for though Europe raised in 1898 1,548,881,000 bushels of wheat to America's 758,000,000, her nations eat so much more bread proportionately that ere the year is half gone she cries to us for food. Not only is it Europe we supply, but the frugal Chinaman, who, having tasted our wheat bread, calls it good, and is wont to forsake his rice and chopsticks for it.

In round numbers, there are to-day 517,000,000 bread eaters in the world. Each year there is added to this number nearly eight millions of people who clamor for bread. Part of these come from increase through new births; more are added by cultivating a taste for wheat. The average wheat flour consumed by each person through the year is about one barrel, or four and one-half bushels of wheat. Americans eat a little more than this average, while the Frenchman and Briton eat still more, and the Russian and German less. At an estimate, then, the bread-eating world requires each year over 2,300,000,000 bushels of wheat to supply its table with bread. In 1897 the crop fell short of this mark by nearly a million bushels, creating high prices in the less fortunate lands, and even causing famine in India. With some fear, it is viewed by scientists like Sir William Crookes that by the year 1931 the world will be crying for more bread than can be supplied by the farms of the entire globe. To show to what an extent nations depend upon the wheat-raising countries, England, whose population consumes her entire crop in thirteen weeks, must needs be supplied for the rest of the year from America, Russia or India, or else die of starvation. In time of war if the United Kingdom were blockaded for three months the whole country would be depopulated. The nations must live on wheat, and to procure it all things possible are done.

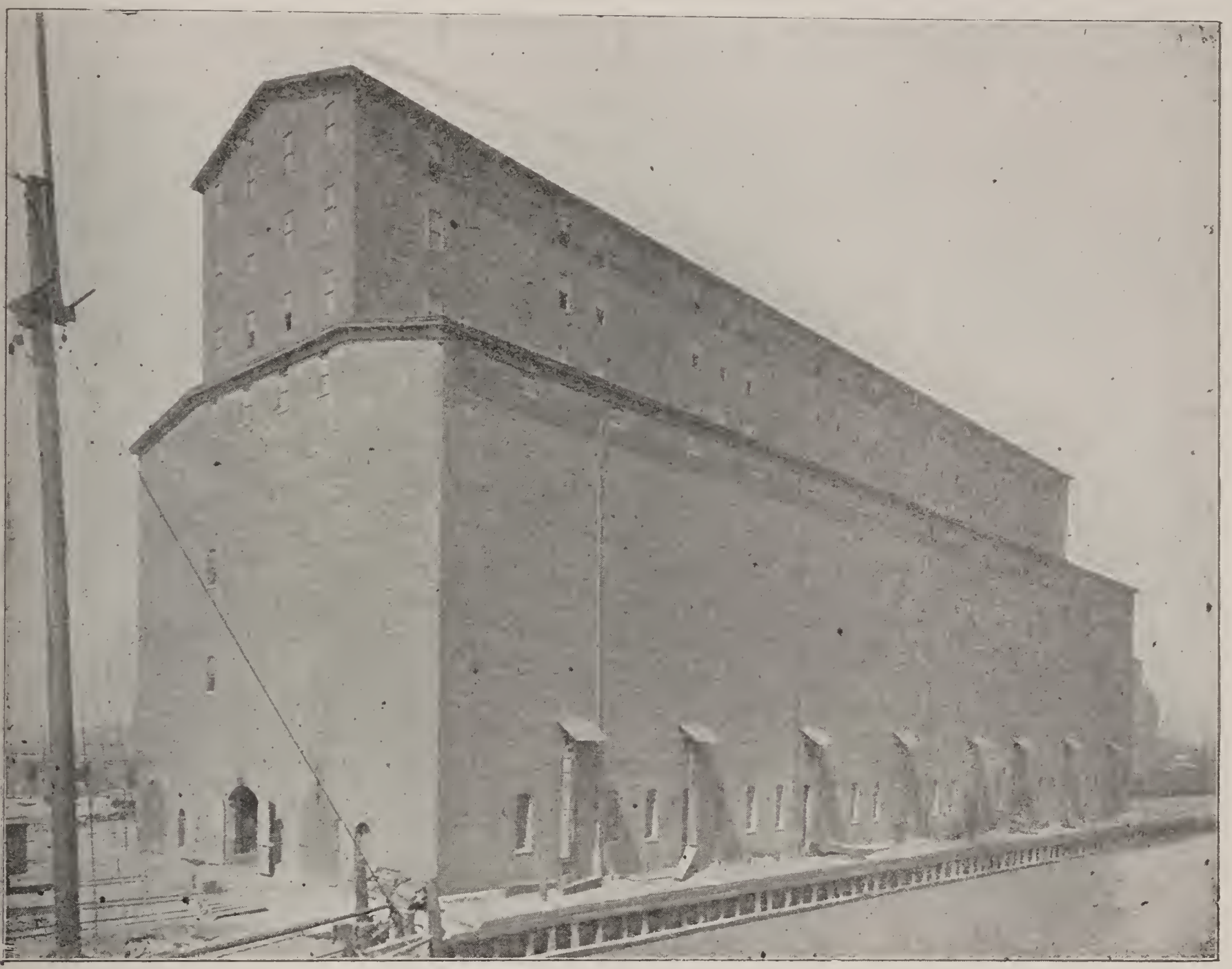
Tide of Wheat.

The tide of wheat traffic flows principally from west to east, and from south to north. There are a few exceptions to this, as where America ships to Brazil and China, and Russia and India ship to England and the rest of Europe, but in the main the great traffic is across the Atlantic. The American, while a great bread eater, does not quite forsake his potatoes, and consequently sends his surplus wheat where he can get the best prices. Gigantic as are American projects in general, the calling of the wheat trader commands the admiration of all. The life of the American public depends on the livelihood of the American farmer. When crops are good general business conditions are buoyant. The man who buys and sells wheat for his vocation

deals in such enormou[illegible]fortunes and with such quantities of the life of nations that the world at large almost bows down to him.

Both the farmer and the trader keep informed as to the exact condition of the markets the world over, and so far has civilization and business instinct entered into the work of the former that he has even had telephones put upon his farms, enabling him at once to learn the exact spot where he can sell his product at the highest price.

So great are the transactions daily in this commodity that the dealers on the boards of trade when they sell "10 wheat" mean 10,000 bushels, and not merely ten bushels. In spite of his great eagerness to dispose of his stock, he never sells down below a certain huge surplus. For instance, July 1, 1899, the "visible supply" in the great terminal elevators at Chicago, Duluth, and Minneapolis together with wheat in transit measured 74,000,000 bushels. The invisible supply in the hands of the farmer roughly estimated was 70,000,000, making a total of such proportions that it is easily explained how a Leiter could not "corner" the wheat market.



A CHICAGO GRAIN ELEVATOR,

On the banks of the Chicago River, one of the largest of its kind in the world, capacity 700,000 bushels. The grain stored is shipped to Europe.

When Wheat Ripens.

Let us follow the movements of this cereal from the harvests to the consumer. At the bottom of the world in Peru and the south of Africa along in November the wheat begins to ripen for its cutting. In December follows the harvest in Burma; in January, Australia and Argentine; in February and March, the East Indies and Upper Egypt; in April, the wheat belt of Asia Minor, Persia, India and Mexico. About May wheat begins to ripen in the lower part of the United States, Japan and northern Africa. When June comes our great harvest begins in earnest, and continues until the last wheat of the Red River Valley is gathered along about the first of September. With this march of the harvests goes the migration of the harvesting hands. Early in the spring he appears unkempt and poverty-stricken, ready to do a man's full work for double wages. And he gets the wage, too, and then disappears to spend it, reappearing the next spring to resume the old task. It is estimated that his tribe numbers at least 50,000 men. This army by means of the latest improved methods of harvesting, reaps, binds, thrashes, and stores up the wheat for sale to the elevator men.



A SCENE ON THE CHICAGO RIVER,

Where grain boats destined for Buffalo are taking on loads for carriage across the Great Lakes.

The primary movement of wheat is toward the local flour mill, where it is ground up to supply the farmer's family, and toward the granary, where it is stored up for the next planting supply. In the States where the crops are not large the supply is consumed almost entirely at

home, and in many States not so much as a kernel gets away to supply other peoples. When the farmer gets all he wants for himself he begins to think of making a profit. This selling surplus in 1898 amounted to 400,000,000 bushels. Of this something less than half is consumed in our cities, while the rest goes abroad either as wheat or flour. There are three general methods for selling this surplus.



INSPECTORS AT A CAR OF GRAIN WHICH THEY ARE TO GRADE.

The farmer who owns acres in the thousands and who can afford from two to ten thrashing machines often maintains one or two elevators on his ground, where he can store his supply until the time when he can dispose of it at a good price. Such men who do business on the wholesale plan often make as high as $30,000 net yearly. Then there is the class of farmers who, though less extensive growers, keep a close acquaintance with the commission men in the great trading centers, and order cars for themselves, shipping their grain direct to the dealers who pay the highest figures. Often they are so enterprising that they sell on the boards for future delivery.

How Farmers Sell.

The great mass of farmers, however, still sell in the old-fashioned way to the local elevator men. To be sure, they keep thoroughly informed on market quotations and sell accordingly, and if prices at the local buyer's hands do not suit him he combines with his neighbors and emulating his larger brothers ships direct to Minneapolis, Duluth or Chicago. The elevator companies at the great centers control warehouses along all railroads, and on water lines throughout the wheat growing districts, and so great is the demand for the commodity that as soon as a local elevator secures a new supply it is telegraphed to the headquarters at the trade center, and is almost as soon disposed of. So rapid is this operation that two-thirds of the year's supply is generally sold before the year is half over.

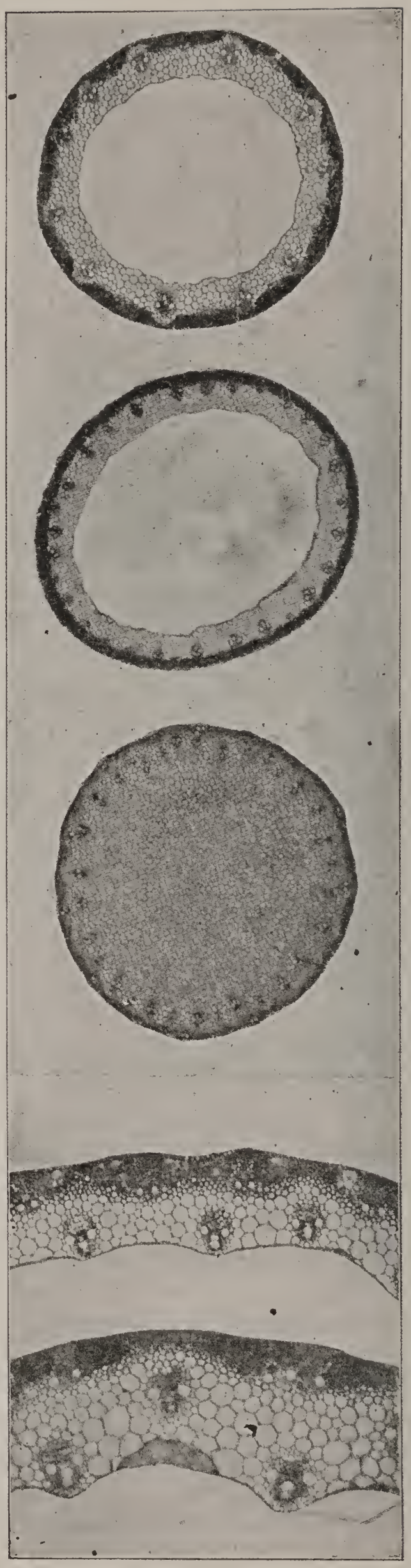
System of Grading.

Perhaps no other one thing so facilitates in the movement of wheat as the system of grading. Time was when every prospective buyer had to inspect each load of wheat for himself, and the business of

trading was full of time-consuming details. Lately, however, the state governments or local boards of trade and chambers of commerce have stepped in and superintended the grading, so that wheat may now be bought safely with the assurance it is of a certain uniform quality. In Minneapolis, which is the largest primary wheat center of the world, this system has reached its perfection. It is controlled by the State Railroad and Warehouse Commission, and meets every August in St. Paul for the purpose of establishing grades for the next year. Grain men from everywhere are invited to be present and make suggestions. In 1899 there were eighteen grades, of which the following were the first two: No. 1, Hard Spring Wheat, which must be sound, bright and well cleaned, and must be composed mostly of hard Scotch Fife, and weigh not less than fifty-eight pounds to the measured bushel: No. 1 Northern Spring Wheat, which must be sound and well cleaned, and must be composed of the hard and soft varieties of spring wheat.

Grain Inspection.

Early in the morning the deputy inspector and his assistants start out to the side-tracked cars full of wheat for their marketward trip. One man goes ahead and records the initials and number of the car, and sees that no one has tampered with the seals. Then comes another who breaks the seal, and then the inspector who delves into the wheat and by sniffing here and taking a pinch there grades its quality. Sometimes he plunges a long hollow tube into the wheat to see that no "sharper" trader has put in a layer of poorer quality. Sometimes he finds it necessary to weigh a quantity in his little brass kettle to see that it comes strictly



After building up the ear, or head of grain, it is necessary to build up a straw capable of supporting the increased ears. The top photograph exhibits a transverse section of the original variety of straw. The outer opaque rim is practically solid to resist the influence of the weather. The inner substance is a mass of cells acting as stays and giving it the necessary strength. The dark bundles near the outer rim are a series of helical springs. These helical springs enable the straw to bend without breaking. The second illustration shows the number of these helical springs increased. The third shows a further increase in these helical springs with interior cells increased so much as to fill up the hollow stem. At the extreme bottom are sections of 1 and 2 magnified to a greater extent.

up to the law. Generally, however, they are so expert that the quality can be told by the mere handling. And the system is honest, for the inspectors do not know whose grain they are inspecting until after it is all done.

Besides this the process includes filling little bags with samples from each car and sealing them with their respective initials and numbers for shipment to the chamber of commerce, where set out in little tin trays they form the basis for the next morning's trading. After the inspector has finished his work the cars are re-sealed by the State to await the disposition of the purchaser. Records are kept by the State until the grain in question has passed out of the market. It sometimes happens that a commission man thinks that the grain sent to him is of higher grade than that given it by the inspector. In that event, if he so wishes, he may have it inspected again by the State board, which, if the grade has been incorrect, pays the expense for re-examination; otherwise the trader must stand it. In 1898, of 220,777 cars inspected in the State of Minnesota, only 16,104 were complained of, and only half this number were incorrectly inspected.



The wheat ear in the center shows the grain before cultivation, only half of the head containing grains, and those small in size, as shown immediately below the ear. The wheat ears or heads on either side show the grain after artificial cross fertilization. This operation necessitates the opening of the case and the removal of the pollen while in an immature state. Later the pollen must be procured from the species with which the cross fertilization is desired and placed in the pistils of the species first operated upon.

In the wheat pits of the boards of trade is done the greater part of the transactions that send the supply all over the world. Here about ten o'clock in the morning, after the samples have been received from the cars, traders, millers and elevator men swarm about the tables arranging deals for delivery of millions of bushels of wheat. Dials on the walls indicate the fluctuations in price according to sales in other cities. A miller wishes so much wheat at a certain figure; it is sold, an easy transaction. But further than this and what has brought the boards of the world into disrepute, is the custom of selling for "future delivery."

Trading in the Sixties.

Back in the sixties, when transportation was difficult, traders up in northern Minnesota had to buy wheat in the fall, store it all winter, and then ship it down the Mississippi in the spring, without the

least idea of what price it would bring. The traders had to buy at a low figure, and stood equal chances of losing or gaining enormously. From this grew the custom of selling for future delivery wheat that was then on hand. This in itself was businesslike enough, but from it has grown the future sales of wheat by men that never have the possession of it nor who ever expect to have, simply a vast system of speculation. Yet it is one that has its conveniences, for it creates markets, and facilitates the swift movement of wheat without the exorbitant costs of grasping middlemen.

After the wheat has been sold, elevator certificates are given for its delivery. These receipts are accepted by banks on loans for almost their face value, and naturally both the banks and State watch the elevators to see that absolute trustworthiness prevails. The great elevator centers of the United States are Minneapolis, Duluth, Chicago and Buffalo. These great steel buildings fitted with every facility for storing, cleaning, drying and scouring wheat and other grain hold from 1,000,000 to 2,500,000 bushels. Great spouts called "legs," through which run moving bucket-belts, are pushed down into the holds of ships or into cars, and the grain is rapidly sucked up into its proper bins. In the holds of vessels gangs of men stand knee-deep in the wheat and shovel it in front of big shovel plows run by steam, which in turn dump the grain into the "legs" for carrying upwards. A cargo of 180,000 bushels can thus be unloaded in a few hours, and when it is considered that at the same time "legs" from the opposite side of the elevator may be re-shipping the grain into cars ready for the seaboard, the magnitude of the operation may be apparent. And all this is done for about one cent a bushel.

Wheat Goes East.

Directly resulting from the storing of the grain in the great elevators pending sale and shipment comes the growth of the great eastern movement of wheat in the United States and the added millions in revenue to the great steamship and railroad companies. Lake transportation is the cheaper for grain, and costs but three-quarters of a mill per ton per mile. Situated as all the elevators are, very near the lakes, the business of transportation of wheat has grown to enormous proportions. Grain shipped by cars to Chicago and Duluth, and by river to Minneapolis finally reaches in most instances the elevators at Buffalo, where, either by rail or canal, it is re-shipped to the seaboard, thence to find its way to Europe. The cost of the transportation of one bushel of wheat from Minneapolis, including three reshipments at Duluth, Buffalo and New York, to almost any point in western Europe is but twenty cents. It is curious that it costs almost as much to transport the same from the Dakota wheat fields to Duluth alone.

And what of the profits accruing from this great wheat industry to the people of America? From about 4,000,000 barrels of flour shipped abroad in 1875, our trade has grown to nearly 20,000,000 barrels. American flour is shipped 5,000 miles to compete with Russian flour, and even the Chinaman is now gladly using our poorer grades. In ten years our flour trade with Japan has increased elevenfold. The total foreign sales for 1899 were $177,000,000, of which Great Britain took $100,000,000 worth. The farmer is growing prosperous under this great production. His estimated gains run from 5 to 12 per cent of his invested capital, and with all the modern improvements and facilities his enormous yearly crop receipts average nearly $400,000,000.

MAKING FLOUR.

Vast Gain Made in Modern Mills—The Stones that Are Used—Experts Studying the Problem—Largest Mills Are in the United States—English Methods.

LAST changes have entered into methods of flour milling since the days when two heavy stones were used by hand to crush the flour from the wheat. In 1900 the machinery employed in the largest mills and the best in the world, viz., those in Minneapolis, Minn., is far in advance of the kind used ten years previous. Experts are continually at work devising contrivances which will lessen the cost of grinding flour and at the same time act in a beneficial way upon the finished product.

In ancient times wheat was placed between a large convex and an equally large concave stone, which fitted into each other in a sort of crude fashion. A strong pair of arms then supplied the power which crushed the flour out of the wheat, but the process was slow and arduous. The first real step in the direction of progress came with the introduction of the quern, which is still used in the Shetland Isles, the Faröes and in some other places. The main difference between the quern and the more modern mill stones is in the size of the upper stone, which now is made larger to permit the turning to be done by water, wind or steam power. Again, the more modern mill stones were, for the most part, made from buhr stone, a sort of silica much like flint in point of hardness, but not so brittle.



THE PILLSBURY FLOUR MILLS AND ELEVATORS AT MINNEAPOLIS, MINN.

The largest plant of its kind in the world and operated by steam and water power.

Mill Stones.

The usual size of a mill stone is four or six feet in diameter. It is made up of a number of pieces of the material, strongly cemented, and then bound together with iron hoops. The grinding surface of the mill stone is grooved. These grooves are cut perpendicular on one side, and with a slant on the other.

Power is communicated to the upper mill stone by means of shafting which is at the end of a spur wheel. The lower mill stone remains stationary, and the grain, poured into a hole in the top of the upper stone, comes between the two and is ground into flour or meal by a force called centrifugal. The finished product passes from the enclosed mill stones down through a spout into what is called the worm, which cools the flour or the meal while carrying it along to the elevators. The elevators raise the product to the silk dressing machines.

This machine is really nothing more than a cylinder. Prior to 1885 it was usually made of wire cloth of several degrees of fineness, thus separating the flour into a variety of qualities, the finest passing through the first portion in the cylinder, the next finest through the second, and so on; no part of any of the screens being fine enough to let through the bran, which passed out from the end of the cylinder. Hoppers were placed below the dressing machine—and are used to this day in some mills—and with their aid the flour and bran are run into sacks.

English Methods.

Some of the large English mills are driven by steam engines, and though they are far ahead of the mills of 1850, they are, in many respects, several degrees behind the more enterprising American methods. In the best English mills the wheat passes through a series of cleaning machines—rapidly revolving beaters inside an iron case—and then through winnowing machines. After being slightly crushed by iron rollers and passed through a sifting machine, the wheat is finally crushed between from thirty to fifty pairs of mill stones.

It is then sifted through silk cylinders; first to separate the bran and then the middlings. Such a mill will produce 1,000 sacks of flour in a single day. Despite this large quantity the best American mills, with the most modern improvements and with a larger capacity, will quadruple this amount, and even do still better under pressure. Among the most valuable improvements of importance since 1875 is the high grinding system which is in use in all the foremost mills in America.

Some Modern Improvements.

This does away with mill stones, and brings into operation rollers, either porcelain or chilled iron, which are more suited to the hard wheats. As a result, the wheat produced is of a finer quality. The method originated in Hungary, which has long led the continent in the production of flour. The middling purifier is another important factor in modern milling methods. The principle is a series of horizontal sieves kept constantly in motion, through which passes a current of air driven by a fan. Following this the middlings, after being put through the purifier, are ground by porcelain rollers and dressed through silk, after the manner of ground wheat. These middling purifiers are the leading feature in America, which no longer knows the mill by the side of a convenient stream of water. A few such are left, but they stand for sentiment and not for progress.

ELECTION OF POPES.

Manner of Choosing a Pontiff—The Rules Followed After a Death—How the Cardinals Meet and Vote—Singular Ceremonies.

ONE of the greatest elections in the world and one which interests all classes is the election of the Pope of the Roman Catholic Church. From the year 1 A. D., when St. Peter was the recognized head of the Roman church, until February 20, 1878, 261 popes were elected. In the early days the custom was to call a meeting of cardinals to elect a successor to the dead Pope in the Lateran or the Vatican basilica, or in the cathedral of any city in which they might have determined to hold the election. The old mode of procedure in papal election was abolished in 1247, when the rules and regulations of the conclave were settled. These still exist, and form the bulwark of the present system.

In 1247 Gregory X., who was similarly elected, called a conference of the great ecclesiastics with the object of establishing permanently the manner of electing the Roman Pontiff. A constitution was there drawn up and approved by the fathers. According to this constitution the cardinals shall celebrate the death of the Pope for nine days, and on the tenth shall come together for the purpose of electing his successor. They shall be accompanied by a single attendant, lay or clerical, or at most, in case of evident necessity, by two attendants. The conclave shall be held in the palace of the late Pope, and the cardinals



THE CATHEDRAL OF MILAN.

One of the great Catholic churches of Europe, at Milan, Italy. The building was begun in 1387 and its extreme height is 355 feet.

must live in common, occupying one large room. One room, however, is reserved for private purposes. While in conference no person shall be allowed to converse with a cardinal, and communication may be had with only such outsiders as are called before the body to discuss matters germane to the subject. No letters or message may be sent under pain of excommunication.

If after three days the cardinals fail to agree, they shall be allowed but one dish of food at dinner and supper during the next five days. After that only bread and water will be given them until an agreement is reached. Nothing shall be taken from the coffers of the vatican while no Pope is in office. Nothing but the election shall be treated unless the temporalities of the Holy See are threatened. If any cardinal attempts to entice his brethren to his own side by offering a bribe, he shall suffer excommunication. Two-thirds of the votes of all present are necessary for an election. Voting by proxy is not recognized, but a cardinal may enter the conclave after it goes in session if he be detained on his journey. Any one, not a woman, a manifest heretic or an infidel, is eligible to the papacy.

GERMAN DUELS.

Students Fight for Glory—Give Each Other Many Scars—Battles that Last for Hours—Usually Fought in an Inn.

THE duels of German students have become famous throughout the world. Instead of turning to football and other athletics, these seekers of knowledge delight in broadsword dueling and exchanging wounds which leave scars on the faces of many for life. The practice is very common, and especially in the southern parts of Germany but little opposition is offered to the so-called sport.

Clubs, corresponding in a way to the Greek letter fraternities in American universities, are the organizations which support the practice. It is under the auspices of these that the tournaments and duels are held. It is as honorable for a student to have his face covered with scars in that country as it is for an American student to be covered with honors of the football field. Many of Germany's most learned men are thus marked, and in many instances professors countenance the "play."

The duels usually come off in a drinking house. The landlord in an out-of-the-way place provides a room, the floor of which is covered with sawdust. The contestants for honors assemble here and don a tough jacket and guard, which is placed on the right arm. This is used not only to protect the arm, but also to parry blows. The seconds and friends of the duelists then gather about the room, and the fight is on. They slash and cut at one another with all the skill which comes from long practice with the sword. Sometimes the fight continues for hours.

as blood has been drawn on neither side. The face is the objective point in all attacks. If a slight wound is given one of the duelists, a halt is called until the attending physician examines the cut. Unless he thinks it sufficiently serious or that it will leave a big scar, the fighting continues as before, although blood flows profusely.

When the men are almost exhausted they become careless. Then it is that a chance blow decides the battle. When a good gash is made a final halt is called. The wounded student is put under the care of a physician, and the audience withdraws with the victor. Next day the wounded student, if he is able, appears as usual at his classes, with great strips of sticking plaster on his face. He is the hero of the hour, and is welcomed everywhere. These clubs often have tournaments in which all present participate. After one of these battles royal there is not a popular student in the school who does not bear some mark of the fray when he presents himself at his classes the following day.

THE MUSK OX.

Raising the Ox for its Fleece—Two Calves are Captured—The Herd in Sweden Now—Weight of the Fleece.

IN Sweden the industry of raising the musk ox for its fleece has been started on a large scale. After making many unsuccessful attempts the Kolkhoff Artic Expedition, which several seasons ago returned to Sweden from Greenland, succeeded in there capturing alive two calves of the musk ox, a male and a female, and in bringing them to Sweden in good condition. In this way the musk ox industry started.

At present there is a large herd of these animals, which are being cared for on a farm in northern Sweden, where all conditions are apparently suitable for their development. The musk ox (Ovibos moschatus) is a singular animal resembling both an ox and a sheep, as the scientific name "ovibos" implies. Its introduction into Sweden will be of great benefit to that country in the opinion of Kolkhoff, who, in flat contradiction to the statements of other zoologists, says that the flesh of the animal is not merely edible, but of very agreeable flavor. As a fully-developed musk ox weighs about 1,500 pounds, this is an important consideration.

But the principal value of the animal lies in its heavy fleece of dark brown wool of extraordinarily strong fiber. The fleece of a single musk ox outweighs those of twenty sheep.

MAUNA LOA.

Remarkable Group of Hawaiian Volcanoes—Their Destructive Power—Size of Craters—Enormous Flow of Lava—Eruptions of the Past.

ON the island of Hawaii there is a remarkable group of mountain peaks and volcanoes, originally constructed by hot matter hurled from the bowels of the earth into the ocean depths and then by successive eruptions built upward until the caps and craters of Mauna Loa, Mauna Kea, Hualalai, Kohala, Kilauea and Kulania rose above the waters and became at their visible bases habitable land.

Of this group Mauna Loa, an active volcano, has been in a state of perturbation for some time, indicating that an overflow was pending with accompanying tidal waves and earthquakes. When the steamship Australia left Honolulu in July, 1899, evidence was at hand that Mauna Loa was engaged in destroying herself. The lava flow was within ten miles of Hilo, the sky was overcast with clouds charged with gas, the sea was much perturbed, and sulphur smoke filled the air for miles beyond the shore lines.

On July 22, 1899, there was a severe earthquake shock in southern California, and at practically the same time a tidal wave in Lake Superior, neither easily explained unless it is assumed, until scientific explanation may be had, that way down in the interior of the earth there



THIS IS A CIGAR FACTORY IN MANILA, THE PHILIPPINES.

Natives are employed exclusively and make a cigar now coming to this country.

might be found sharp traces of a seismic wave extending from boiling Mauna Loa to the uttermost parts of the earth and producing at Los Angeles and in Lake Superior the phenomena which troubled the people.

Mother Earth is as travail as she wills, and where her upper crust may be thin she finds a vent for her inward commotions, and the result at unexpected moments is an earthquake, a tidal wave, a destroying flow of lava. It is within the range of possibilities that, constructed as it has been by volcanic action, Hawaii—one of Uncle Sam's latest possessions—may be effaced from the map, sink back into the depths from which it came, and Mauna Loa and Kilauea become but names on the pages of natural history.



A GAME DINNER IN HAWAII.

The guests wearing garlands of flowers, a beautiful native custom.

Island of Volcanoes.

The Hawaiian or Sandwich group of islands consists of a chain of islands, reefs and banks running nearly 2,000 miles in the direction from northwest to southeast. The highest volcanoes and vastest caldrons of seething lavas are found in Hawaii, the largest member of the group, at its southeastern extremity. In Hawaii, the volcano of Mauna Loa, or the Great Mountain, rises to a height of 13,760 feet, or about 3,000 feet above the vegetable zone. Her crater is in reality a group of craters, known in the native tongue as Mokuaveoveo. They open on the very summit of the mountain, forming a symmetrical cavity. In the center of this cavity is the vast primitive or mother crater, with a mean diameter of 6,000 feet, and a depth of over 1,000 feet.

Offspring of Mauna Loa is the vast lateral crater of Kilauea, which opens on the east flank of its parent. Northwest of Mauna Loa is Mauna Hualali, occasionally active. Still farther on is Mauna Kea, 13,850 feet in height, extinct and snow-capped. All volcanic eruptions of any importance in Hawaii are now confined to Mauna Loa and Kilauea, and it is around them that interest centers in view of the startling tremblings of the earth and the fear that Hawaii itself is doomed to a terrible visitation.

Destruction Predicted.

The natives of Hawaii have invested their volcanoes with fables and legends, have built up about them a mass of romance in which truth and imagination

are so interblended that separation is impossible. If Mauna Loa finally overwhelms the island it will be no more than the natives say she has intended doing for some centuries past. These natives believe that Hawaii was formed by the bursting of a huge egg in midocean, one of the fragments of which became the beautiful isle from which rises the flame-kissed crest of Mauna Loa. The authentic part of the egg story is that past eruptions have created new lands in the Hawaiian group and formed the basis for it.

The legend tellers go on to say that after the bursting of the egg and the uprising of Mauna Loa something or other was done by the first inhabitants to offend the volcano and bring from it the threat that in punishment Hawaii should eventually be returned to the depths in which the egg first took form. Time and time again the lava has poured from the lips of Mauna Loa down onto the villages and fields, and almost but not quite carried out the vengeance. After each outburst of wrath the natives, on finding themselves and the island still in existence, express delight, but with a shake of the head say:

"Next time, ah!"

Gigantic Proportions.

The gigantic proportions of Mauna Loa and companion craters leave no room for doubt that they form one of the principal vents of the earth through which gases and molten matter are hurled out from the interior to the surface. Here are the proportions of the crater of Mauna Loa:

Area, 3.70 square miles, or 2,370 acres.

Circumference, 50,000 feet, or 9.47 miles.

Length, 19,500 feet, or 3.7 miles.

Width, 9,200 feet, or 1.74 miles.

Elevation, 13,760 feet.

These dimensions of Mauna Loa are simply those of the summit crater. The dimensions of Kilauea, the offspring, are:

Area, 4.14 miles, or 2,650 acres.

Circumference, 41,500 feet, or 7.85 miles.

Extreme width, 10,300 feet, or 1.95 miles.

Extreme length, 15,500 feet, or 2.93 miles.

If these proportions are considered extraordinary, what is to be thought of those of Haleakala, on the island of Maui, contiguous to Hawaii? Of course, Haleakala is not an active volcano, but its greatest crater of Maui is the largest in the world. Its dimensions are:

Area, 19 square miles, or 12,160 acres.

Circumference, 105,600 feet, or 60 miles.

Extreme length, 39,500 feet, or 7.48 miles.

Extreme width, 12,500 feet, or 2.37 miles.

Elevation of summit, 10,032 feet.

Elevation of cones in crater, 8,032 and 7,752 feet.

Elevation of cave in floor of crater, 7,380 feet.

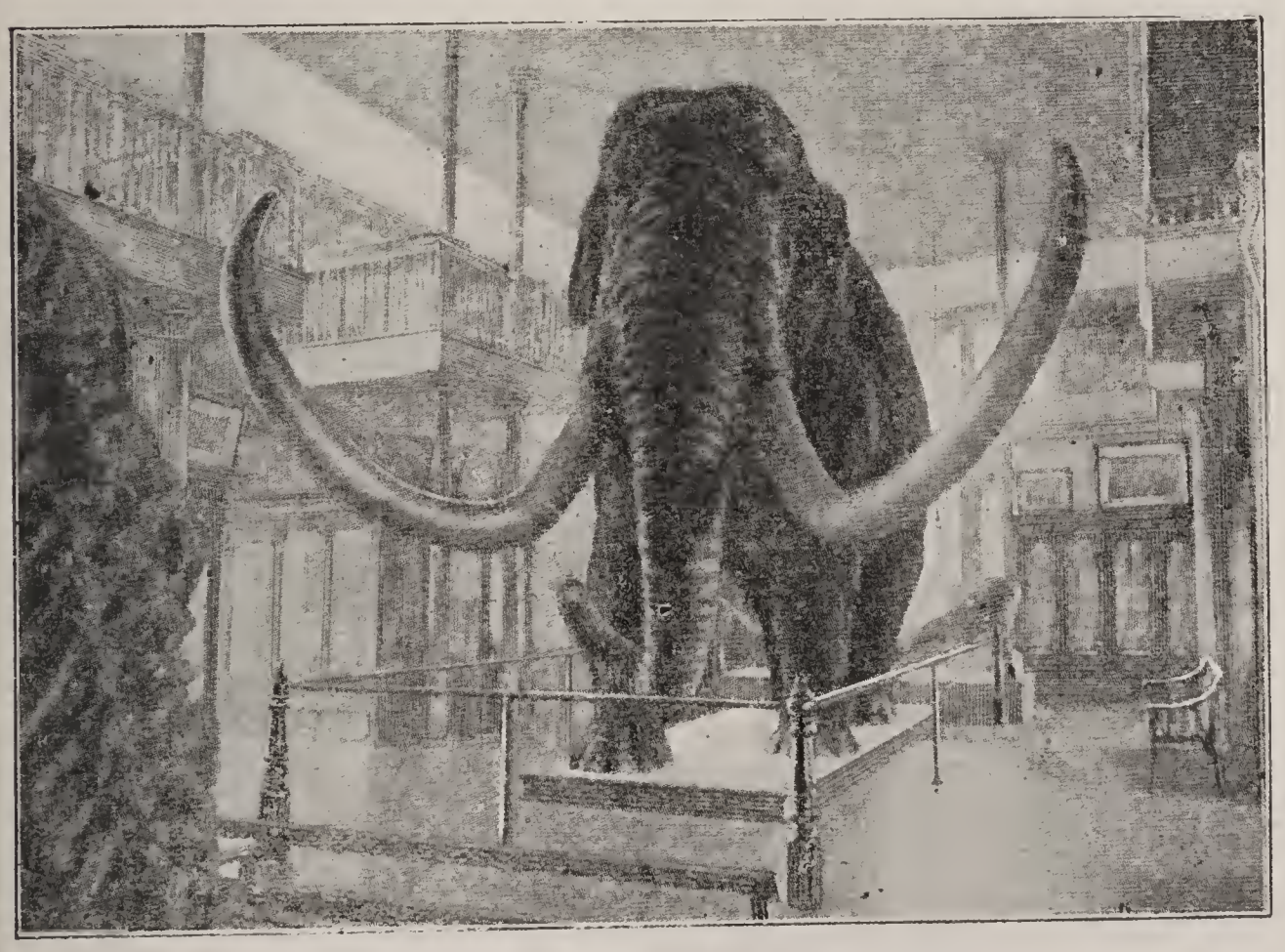
So, if Mauna Loa is to-day the volcano queen of the Hawaiian group, a time was when Haleakala must have been supreme and afforded eruption spectacles such as earth may never see again.

THE MAMMOTH.

An Animal of Prehistoric Days—Tartars Find Its Bones—It Was a Huge, Hairy Elephant—Birthplace Unknown—May Have Come from Asia.

MUCH has been said about the mammoth, its origin, and its haunts when it stalked about the earth. To-day it is unanimously agreed that the animal is extinct, but we have remaining bones, tusks and other portions of the monster's body which give us a great insight into what the beast really was in its day. The first record we have of the animal under a name in any way resembling mammoth is that in which a Russian describes some bones belonging to what the Tartars called a "mamantu"; later on we hear of it as "mammut," then "mammouth," and finally it came down to us as the familiar mammoth. The word to-day is generally applied to gigantic objects, but the name was not given to the animal owing to its extraordinary bulk. Exactly the reverse, however, is true, for the word came to have its present meaning because the original possessor of the name was a huge animal.

Nearly every one knows that the mammoth was a sort of big, hairy elephant, now extinct, and that it lived in the north. The existing elephant of Asia is a very near relative to the mammoth, and in fact may be called a first cousin. The general impression is that the animal was about twenty feet in height and that ordinary elephants would look insignificant in comparison. Such is not the case, and the result of much research is that the mammoth averaged about nine or ten feet. Of course, there were some giants in the family, and it is perhaps



THE MAMMOTH OF ANCIENT DAYS.

Showing size of tusks.

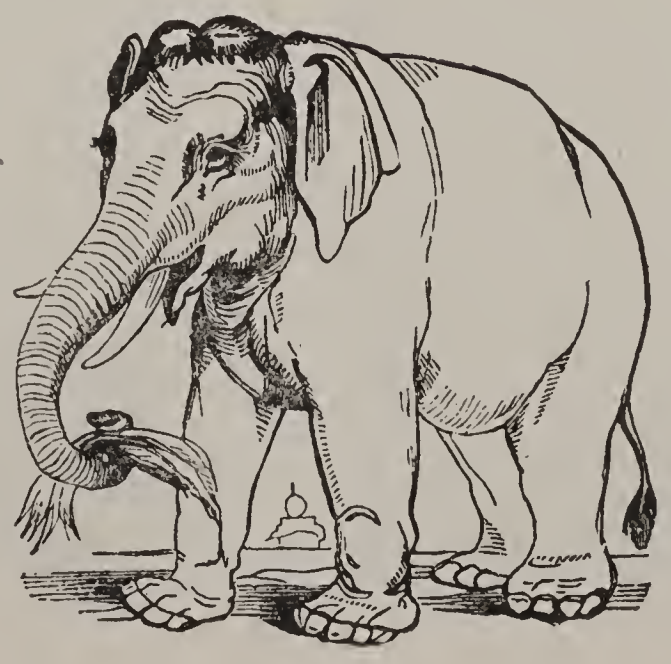
from this that the erroneous idea prevails. Tusks offer convenient terms of comparison: those of an average mammoth are from eight to ten feet in length; those of the famous St. Petersburg specimen and those of the huge specimen in Chicago, measuring respectively nine feet three inches and nine feet eight inches. The largest tusks actually measured were found in Alaska, measuring twelve feet ten inches.

For the external appearance of the animal we are indebted principally to the noted specimen found in 1799 near Lena, embedded in the ice, where it had been reposing, according to geologists, for 10,000 years. Enough of the beast was preserved to show exactly what the covering of the ancient animal was, and that it was fitted out to exist in cold climates and live on the birch and hemlock.

Birthplace Unknown.

Like the birthplace of great characters, the natal place of the mammoth is not known. But the earliest known resting-place of the animal is in the Cromer Forests beds of England, which country was inhabited by him when the German Ocean was dry land and Great Britain was part of a peninsula. His remains are found there to-day, while thousands of mammoth teeth, together with soles and turbot are found by fishermen in the North Sea. If it may be taken as truth as a result of researches that the animal originated in western Europe and not in that great graveyard of fossil elephants, northern India, the theory is that the mammoth went eastward spreading himself all over Europe, north of the Pyrenees and Alps. He did not go to Scandinavia, however, as the glaciers of that country offered no temptations. All along his route he has left us his bones to marvel at for years to come.

How the great animal became extinct when it appears he was so well equipped to protect himself against fellow animals, has never been ascertained. It may be safely said, however, that long ages ago he disappeared off the earth. From flints and inscriptions found on tablets it is conclusively proved that man existed contemporary with the mammoth, but beyond that nothing direct can be obtained.



CONSTITUTIONAL LAW.

When and How Often Congress Shall Meet—Powers of the States—Divisions of Government—President's Duties.

THE Congress of the United States must meet at least once every year, and that meeting shall be on the first Monday in December. The Constitution guarantees every man the right of religion and freedom of speech and the press; it also allows the people peaceably to assemble and to petition the government for redress of wrongs. It guarantees to every citizen a speedy trial by jury, and forbids excessive bail or cruel punishment. No person can be held to answer for a capital or otherwise infamous crime unless upon indictment by a grand jury, and no person can be twice put in jeopardy of life or limb for the same offense.

In all criminal prosecutions the Constitution guarantees the accused the right to be confronted with the witnesses against him, and also the right to have compulsory process for obtaining witnesses in his favor, and to have counsel for his defense. While the XIIIth amendment to the Constitution declares that no slavery or involuntary servitude shall exist except for the punishment of crime, and while the XIVth makes all persons born or naturalized in the United States citizens thereof, and the XVth prohibits any State from abridging the right of vote because of race, color, or previous condition of servitude, yet it does not and cannot secure to the negro the right to vote, or any other person for that matter, for this right lies with the States alone, and is controlled entirely by them.

One State cannot undo the acts of another, yet each State must respect the laws and legal decisions of another. Congress may admit as many new States to the Union as may be desired. A State cannot exercise a power which is vested in Congress alone, and, in general, Congress does not exercise powers not specially vested in it by the Constitution. Yet such can be done under the provision which says that Congress can make all laws necessary to carry out the meaning of the Constitution.

Congress cannot pass a law to punish a crime already committed. When a State law conflicts with a law made by Congress under the direction of the Constitution, the State law is void; as, for instance, when Congress passes a bankruptcy law it annuls all State laws on that subject. The government of the United States is divided into three departments, the legislative, the executive, and the judicial. The former is composed of the two houses of Congress, the House of Representatives and the Senate. In these two bodies is vested the law-making power of the government. The head of the executive department is the President, who is commander-in-chief of the army and

navy, and whose duty it is to see that the laws of Congress are faithfully carried out. The judicial department is made up of the different federal district and circuit courts, and is headed by the Supreme Court, which is the last court of tribunal.

The President has the right to veto all bills presented in Congress, and Congress may not pass such bills over his veto unless by a two-thirds vote. The President has the right of pardon, except in cases of impeachment.



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United States senators are chosen by joint ballots of the legislatures of the States. The representatives are chosen from districts in their respective States by popular vote. Bills for revenue can originate only in the House of Representatives. Treaties made with foreign powers by the President or his secretary must be approved by the Senate. In the Senate every State has two senators, and the smallest State has the same rights as the largest. Congress cannot lay any disabilities on the children of a person convicted of crime or misdemeanor for that cause. Territories each send one delegate to Congress, who has the right of debate, but not the right to vote.



SENATOR A. J. BEVERIDGE.

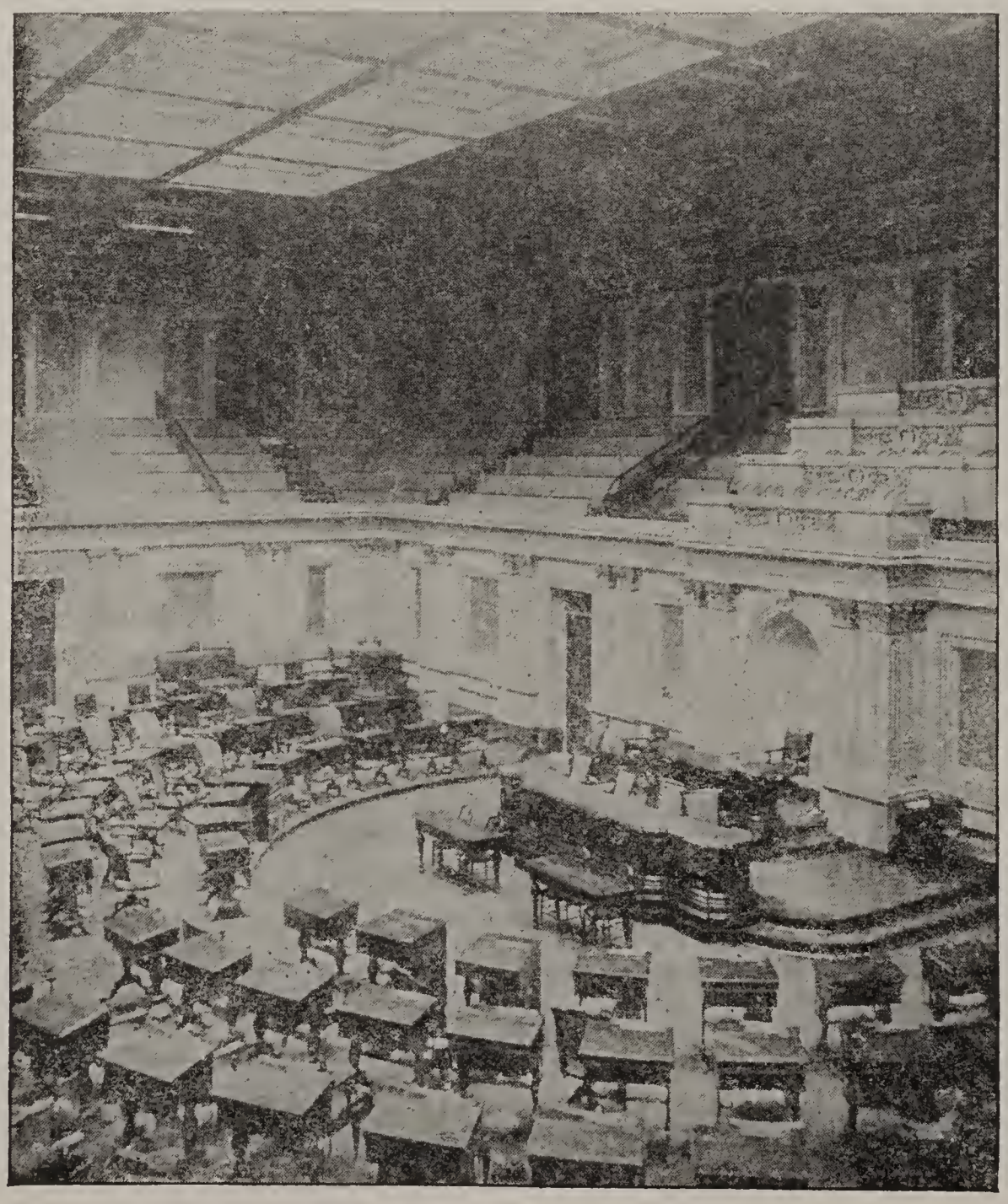
What Treason Is.

Treason against the United States consists only in levying war against them or in adhering to their enemies, giving them aid and comfort, and must be proved by two witnesses to some open act, or else by confession in open court. The Vice-President, who is ex-officio president of the Senate, has no vote in that body except on a tie ballot. An officer of the government cannot accept honors from a foreign power without the permission of Congress. The House of Representatives has the sole power of impeachment, and the Senate has the sole power to try such impeachments. No person can be convicted without a two-thirds vote of the members present. A person committing a crime in one State cannot find refuge in another. The grand jury is a secret tribunal, and may hear only one side of a case. It simply decides whether there is good reason for holding a trial. It consists of twenty-three men, any twelve of whom may indict. To convict, the unani-

mous vote of a petty or trial jury is required.

If the President holds a bill longer than ten days for consideration it becomes a law without his signature. Silver coin in denominations less than one dollar is not legal tender for more than five dollars. Copper and nickel are not legal tender. Money lost in the mails cannot be recovered. To register a letter does not insure it. Congressmen serve two years each term, and may be re-elected. They must be twenty-five years old.

Senators serve six years, and may be returned by the legislatures as often as is seen fit. They must be thirty years old. The President serves four years, and may be re-elected, though no President has served more than two terms. He must be thirty-five years of age. The same qualifications hold good for Vice-President. A naturalized citizen cannot become President or Vice-President, but a male child born of American parents abroad is considered a native born American, and has the full rights of citizenship, including that to become President. Amendments to the Constitution require a two-thirds vote of each house of Congress, and must be ratified by at least three-fourths the States, either by their legislatures or special conventions called for the purpose. When the federal government calls out the State militia they pass out of the control of the State and under the command of the President.



UNITED STATES SENATE, WASHINGTON, D. C.

TAXATION.

Purposes of Taxation—Manner of Assessment and Collection—Property Exempt from Taxation—Single Tax and its Benefits.

IN order to carry out this great government properly, money to the extent of hundreds of millions of dollars is annually required. The average cost of maintenance of public institutions is about ten dollars a person. To secure this sum taxes are levied upon the populations in many different ways, but all to one purpose. In the smaller towns and country districts, where improvements consist mainly in corduroy roads and the little red school house, the tax is much lower than in the great city where large and beautiful parks, boulevards and public squares, charitable hospitals, free colleges, libraries, and other institutions of the sort, are run at the expense of the State or city. In the large cities the tax each year often exceeds $40 for an ordinary twenty-five foot building lot and frame house.

The manner of assessing these taxes and collecting them is very intricate to the person not informed. In every town there is a collector and a treasurer. These are also assessors who determine as nearly as possible the just value of all the property, and upon what people should pay taxes. Each locality has certain special taxes, possibly to support a school, poorhouse and the like. Then the county has additional taxes for certain public institutions, roads, bridges, etc. Added to these are the general expenses of the State officers and institutions, and lastly, though possibly most important, the general or federal government expenses. Generally the assessors ascertain what property should be taxed, then a State board determines the general needs throughout the State, and equalizes the per cent of tax to be levied, after which the different taxing bodies, such as towns, cities, counties, park commissions, school boards, and the like, lay the tax accordingly. The county clerk makes out bills for the tax and sends them out to the property owners. If the returns are slow the collectors get after the owners and finally turn the money over to the county treasurers, who in turn remit it to the different taxing bodies. Such taxation is what is called a direct tax, and is levied on both real estate and personal property.

Double Taxation.

It often happens that a person or company is doubly taxed, and lawfully. A great amount of the wealth of the country is represented by stocks, bonds, mortgages and similar paper. These represent money invested in some concern which generally has in turn invested it in tangible property. For instance, railroad bonds represent money invested in a railroad company, and indicate part owner-

ship in all the property of the road. This tangible property of the road can be and is easily taxed. It happens that many rich people have investments of wealth in no other form than such stocks and bonds, and it would be unfair not to make them pay their share of the taxation of the country. Accordingly, a tax is laid on this form of wealth. Since the tangible property has already been taxed and the stockholder has to stand his share of the expenses out of the decreased dividends, he thus pays a double tax.

The purpose of the law is that each inhabitant who receives the benefits of the country's government should stand his share of their expenses. But when every one agrees that for the benefit of all certain things should not be taxed it is no more than fair that such should be done. Thus, for the public good all school land, fire departments, government property in general, hospitals, colleges, churches, etc., not operated for a public gain, are exempt from taxation. When, however, some institution, such as a large college, invests in property and rents it for gain, it is generally considered that a tax should be paid. Such is the case in general, though in some States charters are given such institutions that exempt them perpetually on the ground that the money thus saved would be put to educational purposes.

Besides such methods of taxation, and which are generally employed to cover the expenses of the State, county and town, there must be some method for raising funds for the general government of the United States. This is done in several ways, of which the indirect method of tariff or customs duties is the principal. This consists in laying on importations of commodities from foreign countries a certain per cent tax, either on the bulk or according to value of the article, before it can be sold in this country. The principal reason for this tax by the federal government is that it is the most easily raised; that is, very little can escape taxation, and it causes little complaint because it is laid in such an indirect manner that very few realize they are paying it.

Protective Tariff.

At every sea-port a custom-house is located where the proper officials examine all incoming goods and levy the customs duty upon it, which must be paid before the goods can be removed. It would seem at first that this is a great hardship on the importer, but it is only temporary, for he in turn adds the tax to the selling price, and in the end the consumer really pays it. From this tariff on imports has sprung the political doctrine of tariff for protection of American industries. Any infant industry in this country that is trying to compete with older establishments in Europe many times find it hard to cope with the lower prices of the old-world commodities. If, therefore, the promoters of such industries can get Congress to place a tax so high that it is almost prohibitive against these importations, the American plants may reap a good harvest.

Two things stand against carrying this policy to the extreme; one is that the people at large wish to get goods at as low prices as possible, and were these tariffs left off the foreign goods could be sold at a great saving to the common people. The other reason is that protective tariff to be protective to the infant industry must be so high that it keeps out the foreign product altogether, and thus frustrates the very idea for which it was made, that of securing revenue for the government, for if the tax is so high that it keeps the goods out no tax can be

levied. There is, however, another side to the question, and which has the support of many,—that is, that the people at large would rather see American industries active and helping the laboring man to earn a livelihood than to be able to secure certain commodities at lower prices.

Besides the customs tax the federal government levies an internal revenue, such as on tobacco, liquors and at times certain general business transactions. The revenue levied on tobacco and liquors is made against the manufacturer, and is generally in the form of a stamp tax which he pays first and then, by adding the expense to the price of his goods, collects later from the consumer. In time of war taxes are levied on almost every conceivable article of consumption and business transactions. At the breaking out of the Spanish American war Congress passed a war tax, which in general called for stamp taxes on nearly every general business transaction. Among others were the stamps required on bank checks, promissory notes, board of trade transactions, insurance policies, deeds of transfer, telegrams, express receipts, and on nearly every bottle or package of proprietary medicine.

Single Tax.

Other forms of raising taxes in certain localities are by licenses to conduct certain business, as saloons, peddlers' wagons, pawnbrokers' shops, etc., and the federal government raises additional revenue by patent fees, postal receipts, sales of public lands, etc. In many cities certain industries are carried on by the government, and the expense is met by the people. Such, for instance, are gas and water plants, and in some countries the railroad and water carriage monopolies.

A plan to do away with the multiform methods of taxation and substitute for all a single or land tax was formulated by Mr. Henry George, a clever political economist, in his book, "Progress and Poverty," in 1879, and has since so gained in popularity that one country, New Zealand, has it in operation. In the United States, England, Germany and many other countries the idea has been adopted in theory, but the day has not yet come when governments think it possible to make such radical changes as the plan suggests. Single tax men start with the fundamental principle that all men are equally entitled to the benefits of nature, among others air, water and land. They hold that inasmuch as the Creator freely gave these to man without partiality every man should have an equal opportunity to derive the benefits therefrom.

Principal of these gifts of nature is that of land. Without it no one can exist, therefore no man or set of men should hold tracts of land for their own use, and thus exclude others from its benefits, unless they pay for such exclusive use. Land is the only thing which mankind could not do without. It is needed by every one in nearly equal degrees; therefore, upon land values Mr. George and his followers would place the only tax. They hold that great land-holders are keeping large tracts of land lying idle when millions of people have not the opportunity to use Nature's gift that would make them free and independent. Consequently some one power should see that the free gift of the Creator should not be monopolized, and to the general government they assign this task.

What Should Be Taxed.

The government is to own all lands, all highways, waters, roads and the necessary accompaniments of land, such as railroads, etc. Not all land would be taxed, but only such as is valuable enough for

some one to wish to use it. It is held that land becomes valuable not from what one person does to improve it, but according to what all society does. Thus a piece of land hundreds of miles from civilization is not generally regarded as of much value. When a town springs up around it and streets are laid out and business is active, that land becomes valuable, not only to the person that was using it, but to every one in the community, for it helps toward making the other land of like value. This value is what is proposed to be taxed.

All other forms of taxation are to be discarded, and no property is to be owned outright by any body but the government. This, it is said by the large land owner, is as bad as the emancipation of the slaves was to the slave holder. Where syndicates have bought up great tracts of idle land and are allowing it to remain idle until civilization and society shall approach and make it of value, and then sell it at a gain, there would be a possible loss. For as long as there is an inch of ground that some one else desires for cultivation, a tax will be put on it accordingly. The landholder could not allow this land to lie idle and still pay a tax, so he would either have to relinquish it or be taxed.

Further than this, since no man could own the land entirely, if any other person came along and saw a piece of ground that just suited his purposes and it was in use he could secure it by paying enough for it. For instance, there is a good farm under cultivation and some farmer thinks it is worth more than the taxes indicate; he will simply ask the government to be allowed to have it, and will state what tax he thinks it is worth,—similar in fact to real estate purchases to-day. The government raises the tax accordingly, and the holder will have to stand the increased tax or sell out his holding rights to the other man. This sale is necessary, for the holder has very likely improved the property by placing buildings, etc., upon it, and the promoters of the plan do not suggest confiscation of the improvements. What single tax really is is little more than a government rent instead of a landlord rent. Such a system would:

1. Simplify the government by dispensing with all taxing bodies, town and other collectors, assessors, etc.

2. Establish absolute free trade with all the world, the same as now exists between the several States of the Union.

3. Take the burden of taxation from the heavily-taxed farming districts, where land is not of great value apart for the improvements,—and part of the plan is not to tax the improvements.

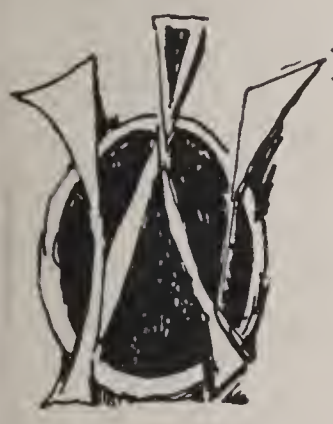
4. Put the tax on highly valuable city lots.

5. Make men pay for public institutions in the proportion that they monopolize the benefits of nature, and make them pay as much for holding land idle as for using it.

6. Make it unprofitable for speculators to hold land unused, enable laborers to have the use of unlimited fields for cultivation of farms, mines, etc., solve the labor problem, raise wages, let every one be employed, and abolish involuntary poverty.

INTERNATIONAL LAW.

Origin of International Law—Influence of Christianity—International Conventions and What they Accomplish—Mediation and Arbitration.



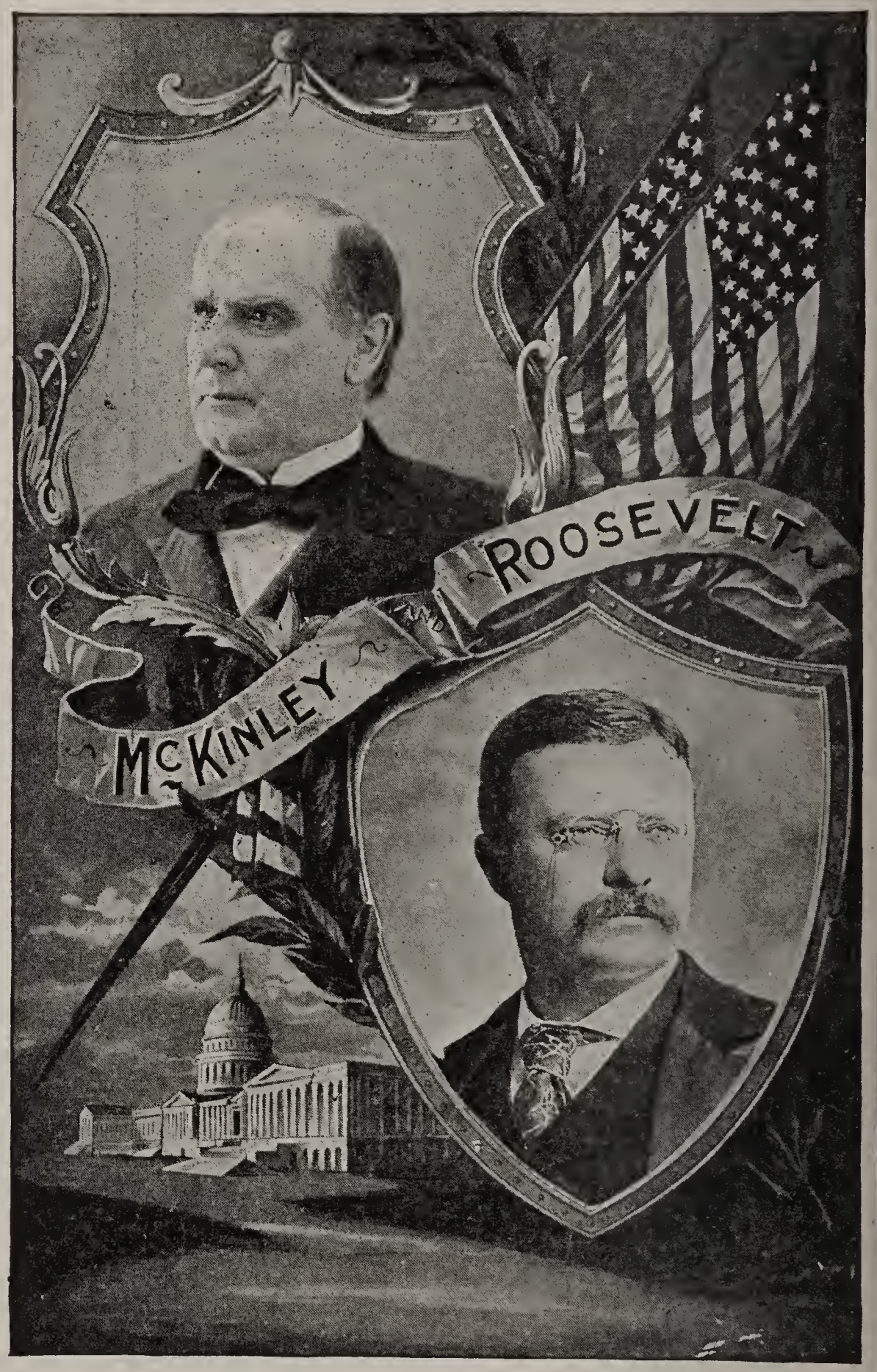
HEN nations first began to evolve from wandering bands of nomadic savages the main idea with each king was to subdue his neighbor. Thus warfare and barbarism were rampant for centuries. With the growth of civilization, however, nations, as well as individuals, began to see that it would be better to get along in peace and harmony with each other. Consequently alliances and treaties were entered into between many states which afterwards led to great republics and empires. The Grecian states came together and united themselves against the Persians, who had before that joined with the Medes. Countries found that they could get along with each other if they agreed to grant each other certain privileges. In this way as well as by conquest the great Roman empire was built up. Then Christianity stepped in as a still greater factor, and people hesitated to subdue or butcher each other because of the simple teachings of the Man of Galilee.



THE WHITE HOUSE, WASHINGTON.

In these first simple agreements between nations we see the beginnings of the great and complex system of the international law of to-day. When one says law he generally means a rule or order set down for following by some power that can enforce its mandates. In

this respect there is hardly what one can call international "law," for the dearest thing to a government is its sovereignty and no country will allow itself to be governed by any other; thus there is really no power to enforce this so-called law. But nations are to-day so united with each other through their interests of trade and commerce, and through their interchange of citizens, that there must be rules laid down for each to follow. First to understand is that these rules, while they partake of nearly all the phases of supremely ordained law, are yet self-imposed; no nation is bound by any power on earth to agree to something against its will, unless it is so weak that it cannot defend itself against its oppressors.



The Flag of Truce.

This branch of law springs up from many sources, among others are common custom that has been laid down by years of usage, agreements between nations themselves, as by treaties, protocols, etc., and by conventions of a number of nations called together for the purpose of considering some particular rule for the government of all. As an example of the first custom it can easily be seen that when Christianity was adopted by all the European countries anything that was particularly abhorrent to its teachings would be warred against in common. Gradually the armies and navies of the world came to see that certain practices were bad for all countries. Thus the flag of truce, which enables enemies to pass each other immune from danger, was found to be beneficial to all sides.

Certain murderous practices of treatments of prisoners were found to be as bad for one side as the other, and were

abolished. Now one never hears of prisoners being subjected to very harsh treatment. Besides these customs acquired by usage and supported by most nations, there are numerous laws upheld by all that are for the good of all mankind, such as, "Pirates are the common enemies of mankind, and shall be punished by death." Thus a pirate ship flying a flag of a country would be captured and punished as readily by that country as another. And any small country, such as the former Barbary States, that formerly upheld these craft in the war upon commerce, would be punished by one or all of the civilized countries.

Treaties that form a part of international law do so only to that degree that they are accepted by both or all the countries that are signers of the agreement. Thus two countries may agree if they so wish that certain malefactors, as murderers or forgers, shall be delivered to the other country for trial simply upon request. This is binding between the two countries, but upon no others. This may be the case in other things, as tariffs, diplomatic services, general commerce, protection, etc. Now, in respect to these treaties, the signatory powers are bound by honor to uphold them till their expiration or revocation by both countries, upon penalty of war if the countries offended see fit to begin it. The treaty is always a part of the highest law of a land, and if that country does not protect the other country by upholding that law, it shows a breach of friendly feelings, and may justify war to protect the injured country's rights.

International Conventions.

Besides the treaties, we have spoken of conventions of a number of countries. These are called together upon certain occasions, and each state is generally represented by men empowered to draft laws suitable to that particular state. Topics are discussed at these meetings, and generally a treaty of all powers present is drawn up prohibiting certain things in war or peace, which, when the treaty is properly ratified by the governments of the countries, becomes absolute law, and all the countries party thereto are bound in honor by it, and may only break it under the liability of severe punishment by the other states. Some of the laws framed at such conventions are that the flag of truce and the hospital flag shall not be fired upon in war; that neutral countries shall not be molested in their shipping by countries at war; that privateering be abolished; that blockades to be binding must be effective, and maintained by a force sufficient to prevent access to the enemy's coast, and that certain murderous bullets shall not be permitted in war. The honor of all the nations concerned upholds these laws very strictly, and when it comes to their violation by a private individual the state generally punishes the offender as severely as though he had violated a municipal law, for, remember, the international law where accepted by the country is as much a part of its other laws as though enacted by its legislative body solely.

In order to carry out the dictates of international law there must, of course, be tribunals for rulings and agents to look after a country's interests abroad. For this purpose courts are provided by the different countries, such as the United States District and Supreme courts, and the High Court of Admiralty of England. These tribunals decide conflicts between municipal and international laws, and carry out their decisions. Each country is represented abroad by ambassadors, ministers, attachés and consuls. An ambassador or minister is an official ap-

pointed by the chief executive, generally with the approval of a legislative body, and looks after the interests of his sovereign, of whom he is directly the representative. For that reason he is held inviolate in the case of war, and is allowed by courtesy to leave the country to which he is accredited and return to his own.

These officials are intrusted with such great topics for discussion with the visited country as the making of treaties, etc. The consul is the commercial agent of his country. It is his duty to report to his sovereign the state of commerce in the country he is visiting. He also looks after the passports of his fellow countrymen traveling abroad, and protects them from the encroachments of harsh laws to which they might by chance be subjected. Ministers and ambassadors also assume many of the duties of consuls, though the main distinction is that the former are the direct representatives of a country to the court of the accredited country, and only one minister or ambassador is sent to one country; while consuls are merely commercial agents, and are sent to nearly every town in which the country has subjects or does any business. Attachés and secretaries of legations are minor officials at the residence of the ministers, and serve in their absence.

The Nations and Arbitration.

Outside of the great duties of the diplomatic corps of carrying on negotiations regarding trade and peaceful negotiations, perhaps the most noteworthy occupation is that relative to war and its following treaties of peace. Countries are very jealous of their sovereign rights, which allow no one to dictate to them what they shall do. If, therefore, they become embroiled in difficulty with another country the last thing they desire is for a third nation to step in and try to settle the fight for them. Civilization, however, dictates that countries shall be charitable and offer their good services to ameliorate the troubles. This takes several forms, such as arbitration, mediation and intervention. The most common method of settling disputes aside from actual conflict is that of arbitration. The countries disputing generally suggest themselves that a third nation or nations appoint commissioners who, together with representatives appointed by the disputants, shall argue the matter and finally accept the majority vote of all for a final decision.

Some of the greatest disputes have been settled in this manner. It also frequently happens that a strong and powerful country sees the folly of allowing a struggle to go on between nations where it might be amicably settled, and offers her good services toward a peaceful solution of the difficulty. This is called mediation, and is generally appreciated as an act of kindness, even if the disputants do not accept the offer. The third form, or intervention, generally comes in the shape of armed forces and the order that a country shall cease its molestations upon pain of war with the interfering nation. Such was the case in the late struggle between Spain and Cuba, and which by the intervention of the United States brought on our war with Spain. This latter method of settling disputes is viewed askance by most nations, and is a dangerous policy.

Since the great peace convention at The Hague in 1899, a number of international laws have been adopted by the family of nations. The Czar of Russia called the conference with the purpose of solving the question of universal peace. The meeting resolved itself, however, into an international convention of international law, and the body of resolutions adopted by it and afterwards ratified by

the legislative bodies of the different countries constitute the new laws. One of them calls for a permanent board of arbitration for the settlement of all disputes between the signers. Any nation may in the future feel perfectly warranted to step in and ask that this board settle a dispute that some other nations are having. This solution is the one nearest perfection that has ever been reached.

INTER-STATE COMMERCE LAW.

Board of Inquiry—What It Does—How Rebates Are Given—Other Methods of Eluding the Law.

BY the power vested in Congress by the clause in the eighth section of Article I of the Constitution, which empowers it to regulate commerce among the several States, that body saw fit, in 1887, to pass the present act which controls and regulates that commerce. The law applies to all carriers of public nature engaged in the trasportation of passengers or property by rail or water, or by both, from one State, Territory or district of the United States into any other State, Territory or district. By State sovereignty over its own territory and jurisdiction any one of the States, of course, can regulate its internal commerce without the interference of the federal government, but so soon as the commerce takes on an inter-state aspect by transit into other States or Territories, the federal government is empowered by the Constitution to regulate it.



THE GREAT ST. LOUIS BRIDGE OVER THE MISSISSIPPI RIVER.

Connecting the city and East St. Louis. All railroad trains entering the city must cross this bridge and every passenger pay a toll of twenty-five cents. The bridge is owned by a private corporation..

The law provides for a board of five commissioners, empowered to inquire into the management of transportation companies and the reasonableness of their charges. Among other

things, the act requires that all rates shall be just and reasonable, and that charges for a short haul shall not be more in proportion than for a longer haul on the same line and in the same direction when the circumstances and conditions are similar. This clause in the law was particularly intended to work against the discrimination by the railroad companies in favor of large shippers, who were getting lower rates in proportion than the smaller shippers, and thus could control the market in a number of commodities.

As it is now, any rebates for such cause are illegal, though in fact nearly all the great meat, grain, harvesting machinery, oil, coal and other dealers in similar goods have secret arrangements whereby the law is subverted and the rebates received from the transportation companies. This evil was fought for years before the inter-state commerce law was enacted, but with little effect. By clever pooling of the different railroads, a big grain shipper can send his freight from the Dakota grain fields clear to New York more cheaply than can the smaller fry from Ohio. This gives the Dakotan a chance to shade the market by a good fraction of a cent, and thus to get rid of his supply, when the other farmer must either charge more and stand the chance of slower sales, or else meet the figure of the Dakotan and not make so large a profit.



MISSISSIPPI RIVER STEAMBOAT.

At her landing, preparing to take on freight. These steamers are smaller than either lake or ocean vessels.

Another manner for eluding the law and for gaining more business for both the road and the dealer is in the harvesting machinery business. In order to retain the large freight shipments of harvesting machinery houses, railroads sometimes grant, contrary to law, a rebate of 25 per cent to the shippers. This big saving in expense to the manufacturers of course influences them to turn all their business over to that road, and while a gain for the road, is a greater gain to them, as it enables them to place their machines in the field at such greatly reduced rates that they can easily outbid their competitors.

All these violations of the law were foreseen and stipulated against in the law, such as by the enactment that there shall be no discrimination between persons or classes of traffic or localities. The law

also calls for public printing of the rates charged, and that the books of the companies shall be open annually for inspection by the commission. Exceptions are made in the act for the carriage of the property of the United States or municipal governments, charitable institutions or to and from fairs and expositions, and it allows the issuing of mileage, excursion and commutation tickets, and permits the issuing of reduced rates of transportation to ministers of religion, and free tickets to officers of the carrier or other carriers.

TEST CAR OF THE UNIVERSITY OF ILLINOIS.

What the Car Is to Accomplish—How It Is Equipped—Its Dimensions—Apparatus Used.

THE University of Illinois and the Illinois Central Railroad have joined hands in an unique undertaking that promises to revolutionize some parts of university work and to bring practical knowledge of railroad work home to students with new force. The university and the railroad have completed a test car. The car is designed, in the language of Prof. Edward C. Schmidt, of the university, for general railroad experimental work, and is adapted for the following purposes:

Measurement of train resistance.
Autographic track inspection.
Locomotive road tests.
Air-brake tests.
Station tests.

The car is owned and operated jointly by the Illinois Central and the railroad mechanical engineering department of the university. The car was built by the road, and the apparatus and other equipment by the university. Hydraulic transmission of the pressure and motion has been adopted for both the apparatus for dynamometric work and for track inspection. The three men responsible for the car and its equipment are William Renshaw, superintendent of machinery of the Illinois Central; Prof. L. P. Breckenridge, and Prof. Edward C. Schmidt of the University.

In building the car care was taken to give it extraordinary weight, in order that it might withstand the usage it will receive in the heaviest freight service. It is 45 feet 4 inches long and 40 feet over the end sills. The inside width is 8 feet 4⅜ inches, the outside width 9 feet 1⅝ inches, and an extreme width over the observation windows of 10½ feet.

Division of Space.

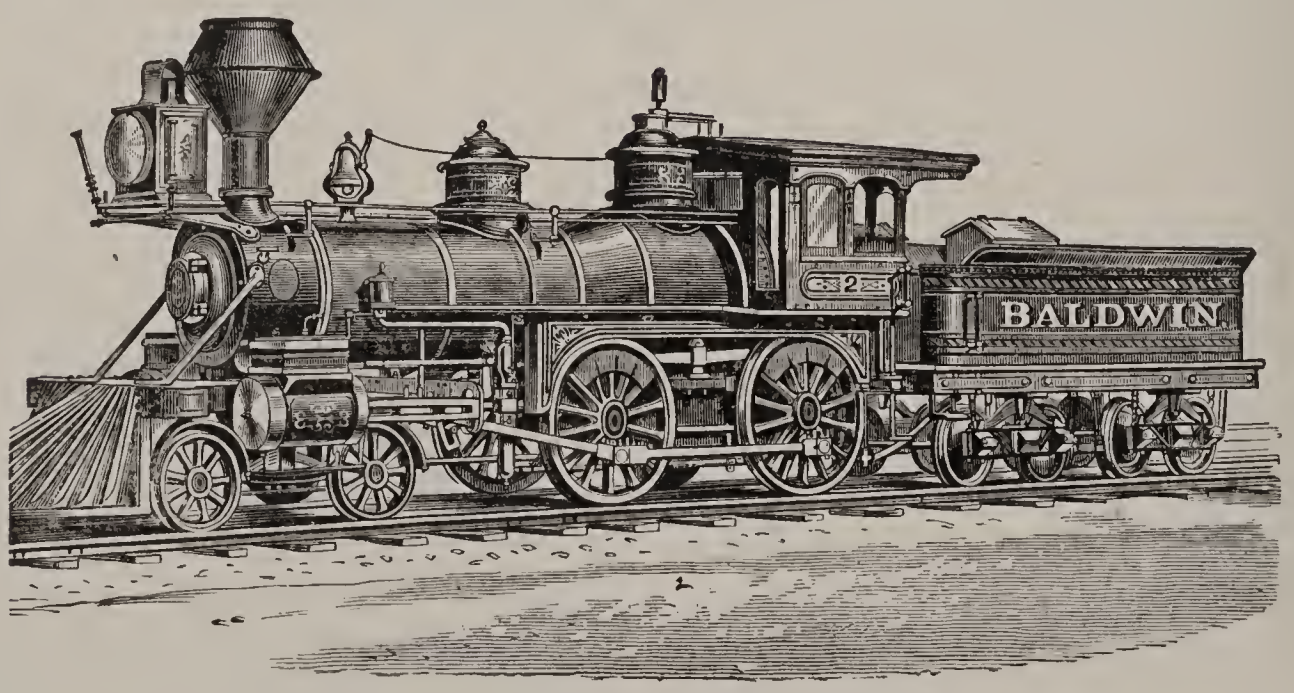
The space given up to berths, lockers and toilet rooms for the use of the students and professors is about fifteen feet. The working space for the tables and instruments is a little over forty feet. On the rear of the car a lookout is provided, from which the handling of the train may be observed. In this lookout are signal push buttons and pens for the dynamometer record of location of mile posts, stations, curves and grades. At the front end are projecting windows, from

which the train and engine may be watched.

The apparatus for the measurement of train resistance is practically completed. So fine is this apparatus that the pressure due to the pull on the drawbar is taken in a cylinder filled with oil, and this oil transmits this pressure to the recording and indicating gauges. It is provided that the record of the amount of drawbar pull shall be made on a continuous strip of paper. This paper is driven from the car axle. Upon it are marked, in addition to the curve showing the pull on the drawbar, the location of mile posts and stations, and also the time. The mile post pen is controlled by electro-magnets. It is drawn slightly aside at stations and mile posts by the magnet when the observer in the lookout touches a button. The pen which records the time is automatically controlled by a clock, which makes electric contacts every five or ten seconds, as may be desired. A speed recorder is also provided for. The oil pump receives its supply from an oil tank, and by arranged piping forces it into the three cylinders of the dynamometer. Oil is cleared from the cylinders by the use of compressed air.

It has been arranged that the working pressure of the oil in the cylinders shall be from 300 to 1,000 pounds per square inch, and for this range of pressures the first, or largest, cylinder has sufficient capacity for the heaviest freight service. The intermediate cylinder will be used on a train of ordinary tonnage and the smallest cylinder in passenger service. To the table upon which are the dynamometer recording gauge, the rolls for driving the paper chart and the Boyer speed gauge, has been attached a vertical shaft, which derives its motion from the car axle by means of spiral and bevel gears.

In addition to this apparatus the car is equipped for locomotive road tests with gauges for indicating and recording boiler pressure and steam-chest pressure, duplex air gauge, air-brake train line pressure recording gauge, and the other apparatus used in locomotive tests.



THE GRAND CANON.

A Wonderful Freak of Nature—Located in Arizona—A Great Gorge in the Mountains Caused by Water Erosion.

THE Grand Cañon of the Colorado was discovered by the early Spanish explorers in 1540, and lies in the northern part of Arizona. At the first view of the Grand Cañon one is unimpressed by any detail; but is overwhelmed by the ensemble of the stupendous panorama, a thousand miles in extent, that lies wholly beneath the eye, as if one stood upon a mountain top instead of the level brink of a fearful chasm, whose opposite shore is thirteen miles away, and whose depths are more than six thousand feet below. A cañon, but not the accepted type; an intricate system of cañons, rather, each subordinate to the river channel in the midst, which is itself subordinate to the total effect. The spectacle is so symmetrical and so completely excludes the outside world, and its accustomed standards, that only by descending into the cañon is it possible to comprehend anything of its proportions.



FINGAL'S CAVE, SCOTLAND.

Hewn out by the ocean waves and supposed to have been occupied by Fingal, bard and ancient king.

YELLOWSTONE NATIONAL PARK.

Wonders of the Geysers—Lofty Mountain Peaks—Canons of Beauty—Mammoth Hot Springs—A Mountain Lake.

YELLOWSTONE National Park, of Wyoming, the greatest natural wonderland in the world, presents a very wide range of phenomena in its 3;000 square miles of territory. In reality, it is not a park, but rather an aggregation of parks, with lofty mountains, great lakes, crystal cascades and mighty cataracts, deep and wonderfully made cañons, translucent springs, painted cliffs, spouting geysers, mountain valleys, mud volcanoes, sulphur mountains, and thousands of deer, elk, antelope, bears, beavers, wild fowl and feathered game, and the streams full of trout.



OLD FAITHFUL.

One of the great geysers of the Yellowstone Park, spouting scalding water and steam.

The park is well provided with modern hotels, near the more prominent points of interest, among which are the Mammoth Hot Springs, with their peculiar cliffs or terraces, covering a large area on the side of Terrace Mountain, at the base of which stands Liberty Cap, an extinct geyser of strange form, while above it are Cleopatra, Minerva, Pulpit, Mount and Jupiter terraces, and higher still are Devil's Kitchen, Cupid's Cave and Angel Terrace. In Norris Geyser Basin one finds the Black Growler, the only steam geyser in

the park, and one that is always roaring; furiously boiling springs of yellow, green, pearl and white water, a beautiful terrace like white marble; the Devil's Inkstand; Congress Spring and Monarch Geyser.

Then passing Elk Park, through Gibbon Cañon and the valley of the Firehole River to the Geyser basins. In Lower Geyser Basin are Fountain Geyser, Clepsydra Spring and the Wonderful Paint Pots. In the Upper Basin are the Old Faithful, Bee Hive, Castle and other famous geysers. Black Sand Pool, Cliff Spring, Sunset Lake, Emerald Pool and the Three Sisters. Yellowstone Lake is one of the highest known lakes in the world—7,741 feet above the sea level—very irregular in form, and the shores picturesque.

WEIGHT OF CATTLE.

How to Compute Weights of Cattle—Table of Factors—The Fractional Weight of Quarters and Hide.

TO compute the dressed weight of cattle measure as follows in feet:

1. The girth close behind the shoulders, that is, over the crop and under the plate, immediately behind the elbow.

2. The length from a point between the neck and body, or vertically above the junction of the cervical and dorsal processes of the spine, along the back to the bone at the tail, and in a vertical line with the rump.

Then multiply the square of the girth in feet by the length, and multiply the result by factors in the following table, and the quotient will give the dressed weight of quarters:

Condition—	Heifer, Steer or Bullock.	Bull.
Half fat	3.15	3.36
Moderate fat	3.36	3.5
Prime fat	3.5	3.64
Very prime fat	3.64	3.85
Extra fat	3.78	4.06

Illustration: The girth of a prime fat bullock is 7 feet 2 inches, and length measured as above, 4 feet 5 inches.

Seven feet 2 inches equals 7.17, and 7.17 squared equals 51.4, which multiplied by 4 feet 5 inches and by 3.5 equals 794.5 pounds. Exact weight was 799 lbs.

Comparative Weights.

Quarters of a beef exceed by a little half weight of living animal. Hide weighs about eighteenth part, and tallow twelfth part of the animal.

COMPARATIVE WEIGHTS OF LIVE BEEVES AND OF BEEF.

	Lbs.	Per cent.
Bullocks	2,800	72 to 78
Heifers	2,600	70 to 76
Bullocks	2,600	
Heifers	2,400	66 to 70
Bullocks	2,400	
Heifers	2,100	64 to 68
Bullocks	2,100	
Heifers	1,800	63 to 66
Bullocks	1,550	61 to 64
Heifers	1,550	
Bullocks	1,260	58 to 61
Heifers	1,200	
Bullocks	1,050	57 to 58
Heifers	1,050	
Bullocks	980	50 to 56
Heifers	950	

THE FILIPINO IN SPORT.

How the Islanders Hunt—They Are True Sportsmen—Ducks and Snipe Are Plentiful—Cock-Fighting Indulged In.

THE Filipino is a hunter and a sportsman. He does not hunt for the purpose of profit. Although he is something of a vegetarian, he keeps his larder supplied with ducks, snipe, pheasant and deer. The serious sport is in hunting the boar, wildcat and wild water-buffalo. The Filipino's weapons consist of ancient carbines of the flint-lock type, bamboo arrows, spears and boloes.

The native is fond of carabao (wild water-buffalo) hunting. It is too hazardous to attract the Englishman. The carabao is found in the Camatines, in the center and north of Luzon, and in the vicinity of Manila. The deer consist of three varieties, two of them peculiar to the island; small and fleet-footed. The smallest is the cherrotain or mouse deer, not much larger than a house cat. Snipe, quail and wild duck inhabit the marshes and rice fields.

The national sport is cock-fighting. This amounts to almost a passion with the natives. Sunday is the favorite day for a fight, but no holiday is complete without one. Men, women and children attend these fights, and



JAPANESE WRESTLERS.

Engaged in their favorite sport, with a third acting as umpire or referee. The Japanese are experts in wrestling, being wiry and agile.

women gamble as freely as the men on every point of the bird's chances. Even the children cannot resist it. The wife and children are often neglected that these fighting cocks may receive proper attention.

The sport of the higher class of Filipinos is polo. Many of the towns have good courses. The Filipino pony is not a native of the islands, but was originally brought over from China. It is swift, stocky and handsome. It thrives on water sweetened with molasses and rice paddy. It sleeps on a stone floor and is quite frisky. The rich half-caste element indulge in fencing, the knowledge of which was brought from Madrid and Paris by General Luna.

IGORROTE RUNNERS OF THE PHILIPPINES.

Men Who Travel Far—Bearers of Burdens—Well-built Racers—Sleep at Any Time —Carry Food for Others.

THE Igorrotes of the Philippines are a race of long-distance burden-carriers and runners. They are a bundle of muscle, and their physical development is fine. The basket they use for carrying purposes is called chu-gee, and is a framework consisting of a strong back, rectangular in shape, made of split bamboo or hard-wood splints, about sixteen inches across and thirty



FRUIT GATHERERS AND MERCHANTS OF THE ISLAND OF LUZON, THE PHILIPPINES

Their style of dress and manner of house building also shown.

inches high, which fits on the back, projecting at its upper end above the nape of the neck, while the lower end rests well down on the spine. To this framework is fastened, about a third of its way down, tied on each side, forming a single loop, a heavy carrying-band, made of dried and beaten manila hemp. It is passed over the upper point of the forehead, and ordinarily sustains most of the weight of the load. There are other bands which pass under the arm and over the shoulder, so that when the carrier's neck becomes tired he can throw the weight on the shoulders.

Narrow wings, or side flaps and a bottom piece are added to this device. These are drawn up against the load, as retaining boards. The Igorrote's training begins when he is about eight or nine years old, by following long and difficult trails until he becomes hardened. The little mountain horse so common in the Philippines is not used as a beast of burden, as it is said he could not make the difficult inland trips more than once in ten days and keep in condition, while the human beast of burden can make them day after day and keep in condition. All food and merchandise which goes into the interior of these countries is packed on the backs of these carriers and thus transported.



CAMP OF U. S. TROOPS BOUND FOR THE PHILIPPINES.
At the Presidio, San Francisco—Awaiting orders.



SAME CAMP OF U. S. TROOPS.
Three minutes after the order was given to strike tents and form for marching.

Like the Chinese, the Igorrotes can sleep anywhere, and their power of endurance is almost as great. The women

perform an equal share of work with the men. They have a basket of their own, differing from that of the men in that it is round and tapering at the bottom. It is carried in much the same way as the chu-gee. These carriers have been very useful to the American army in the Philippines, keeping the garrisons supplied with food by carrying it from the coast depots. And the trail followed through the mountains, up and down, is not an easy one to travel. The only garment which the Igorrotes wear is a katap or cotton shawl for the protection of their backs and heads at night. When dusk comes on they light small camp fires, boil their rice and potatoes, which they eat with their hands from the common pot. After the meal each man smokes a pipe, and his tobacco is not the best, but he is satisfied.

WHEN MOUNTAINS BLOW THEIR HEADS OFF.

Great Volcanic Eruptions—Krakatoa and Its Ruin—Streams of Lava and Water—Thousands of Lives Lost.

THERE are two kinds of eruptions to be noted in the history of volcanoes, those that build up slowly and those that destroy swiftly. The eruptions that build up mountains are periodical wellings over of molten lava. The others are violent explosions, occurring at irregular intervals and bringing widespread destruction. It often happens in the case of a volcano that builds itself up, when the lava forms a hard shell and the crater crusts over at the top, men say the volcano is dead. But this is not true. The fires are there at the core—latent energy ready to be stirred. The cause of the sudden eruption of these volcanoes is the same principal as a bursting boiler—the sudden and excessive generation of steam caused by the hot part of a volcano coming in contact with water. This contact may be due to the readjustment of strata or materials beneath, so that a stream of water is turned into the crater.

The greatest explosion ever known was that of Krakatoa, August 26 and 27, 1883—a little island in the Strait of Sunda between Java and Sumatra. Krakatoa had but one peak, measuring scarcely 3,000 feet. The island was uninhabited and not touched by ships. The volcano itself was considered insignificant. For nearly two hundred years the volcano had been considered as dead, but on May 20, 1883, she began to roar and rumble. For three months this continued until the 24th of June when a second crater opened. After this a third opened. The low-lying walls of the craters gave way in many places. Then thousands of tons of water surged downward on August 26th. Explosion followed explosion until there came one more violent than all the rest. The noise was heard at St. Lucia Bay, Borneo, 1,116 miles distant; at Perth, West Australia, 1,902 miles away; at Alice Springs, South Australia, 2,233 miles distant; and at Diego Garcia, an island in the Indian Ocean, 2,267 miles distant.

Destruction Wrought

The force of the explosion disturbed the water to such an extent that lighthouses in the Strait of Sunda, towns and villages on the shores of Java and Sumatra bordering the strait, boats and vessels on the same shores, were all destroyed and nearly 37,000 thousand lives lost.

The greatest explosion of the eighteenth century was that of Asama in 1783, which has been regarded by many authorities as one of the most frightful in the history of volcanoes. Asama rises to a height of 8,000 feet, and according to records sent down a river of mud from five to ten miles broad, that overwhelmed forty-two villages. The records continue:



A MOUNTAIN SCENE ON THE SANTIAGO & VALPARAISO RAILWAY IN CHILE, SOUTH AMERICA.
The bridge construction is fine.

"In some places the mud was so hot that it did not stop boiling for twenty-four days. In the Tonezawa River immense masses of lava remained red hot even in the river itself. In Kurogano a stone 120 by 264 feet, one among many, fell into a river and formed an island. Two rivers were sucked up into the mud torrent and their places taken by dry land, and the noise of the explosion was like a thousand thunders. The lakes were poisoned, the fish sickened, the rivers were full of dead dogs, deer and



BRIDGE ON THE CUSCO RAILROAD, SOUTH AMERICA.
Showing elevations in the Andes and class of bridge work.

monkeys, with hair singed from their bodies."

Then there was old Bandaisan, in Japan. For years this innocent volcano was regarded as dead. No one knew of any eruptions, and the inhabitants nearby felt perfectly safe, but on July 15, 1888, Bandaisan, without warning and apparently without reason, blew her head off and discharged 1,600,000,000 cubic yards of rock and earth.

The Bandaisan and Krakatoa Eruptions are the most famous of modern times. The active volcanoes of the Hawaiian islands have caused considerable uneasiness. The Asiatic and American shores of the Pacific Ocean are dotted with volcanoes from Japan to the islands of the Indian Ocean, and from Patagonia to Alaska, but the most active volcanic center in the world is the Java island and its vicinity. This island, having about the area of England, contains forty-nine great volcanic cones, some of which are 12,010 feet in height. Etna has more than two hundred quite conspicuous cones within a radius of ten miles from the center of the main crater. Little was known of the volcanic forces pent up in Vesuvius prior to 79 A. D., when the great catastrophe took place, destroying Pompeii.

THE CARRIER PIGEON.

Their Value in Peace and War—Dr. Andree Used Them—The Homing Pigeon—High Speed Attained.

DURING the last few years no phenomenon more interesting and unsolvable than the feats of the carrier or homing pigeon has presented itself. This bird has proved to be of inestimable value both in times of peace and of war. Were it not for the services of one of these faithful animals the scientific world would be without the reports of Dr. Andree's arctic explorations. In the late Philippine war the bird demonstrated its value by carrying messages for the army. In times of peace it is utilized for carrying the results of yacht races and other messages where access cannot be had to the telegraph.

A remarkable feature in connection with the homing pigeons, and one that is not generally known, is the wonderful instinct the bird has for finding its home. The general opinion is that the bird may be started with a message from any point to another given point. Such is not the case. The pigeon will return to its home and nowhere else. These birds have been taken in boxes thousands of miles and then permitted to spread their wings to the air. They soar towards the heavens for a few minutes and then dart out in a direct line for their homes.

In making these flights the speed attained by the birds is remarkable. In many instances a rate of speed has been maintained for a thousand miles which cannot be excelled by the Empire State Express itself. The breeding of these birds is now more than a sport; it is a profession. Several experts are giving their time and money to the training of these birds, and their pedigrees, like that of great race horses, may be found to extend for generations.

FOREIGN TRADE GAIN.

United States Leads All Nations—Important Statistics Collected—A Hundred Years' Growth—National Prosperity Shown.

IT is in the exportation of manufactured products that the United States is making the greatest strides, showing that we are no longer simply an agricultural nation. The exportation of manufactures alone in the nine months ending with September, 1900, amounted to $338,687,243, against $227,502,649 in the corresponding months of 1899, and $145,793,834 in the same months of 1895.



THE BOURSE, OR WALL STREET, OF LONDON.

Where the prices of the money market of the world are made and unmade every legal day of the year.

Thus the exportation of manufactures has increased nearly 25 per cent in one year, and has more than doubled in four years from 1896 to 1900, while the importation of manufacturers' materials has also increased at a very rapid rate.

Exports of manufactures of iron and steel alone amounted to $110,000,000 in round numbers, in the ten months ending with October, 1900, against $86,000,000 in the corresponding months of 1899, and $51,000,000 in the corresponding months of 1897, thus having more than doubled in the three years from 1897 to 1900.

Not only have the manufacturer and the millions dependent upon his industry shared in the prosperity, but those engaged in agriculture and mining seem to have been equally prosperous, judging from the record shown by the figures of our export commerce. The exportation of agricultural products in the ten months ending with October, 1900, is in round terms $700,000,000, as against $625,000,000 in the same months of 1899, while the products of the mine, the forest and the fisheries also show an increase in 1900 as compared with the figures of 1899.

This increase in the products of industry is especially interesting in the fact that in many cases it shows a higher reward for a given quantity of labor or in other words higher prices received for the article itself, as well as an increase in the quantity produced and sold.



LONDON BRIDGE AT THE NOON HOUR.

When it carries the greatest throng. The bridge is famous in poetry, prose and song, and crosses the river Thames.

Producers Earn More.

In cotton, for instance, the average export price per pound in the months of September and October, the beginning of the new cotton year, has been 9.9 cents against 6.7 cents in the same months of the preceding year, while in other agricultural productions and in various lines of manufactures especially those of iron and steel, and in the products of the mine there are increased prices per unit of quantity, and thus better earnings for those who produce them.

A comparison of conditions in the United States with those in other countries, as measured by the foreign commerce, indicates a degree of prosperity which compares favorably with any country of the world. Our own exports for the ten months ending with October

show an increase, as has already been noted, of $166,000,000, while in the exports of the United Kingdom the increase in ten months is $125,000,000; while the 1900 figures for Belgium, France, Spain and Italy show no increase in exportations during that part of the year 1900 whose record is now available.

In the case of Belgium, France, Spain, Italy, Germany and the United Kingdom, the imports are greater than the exports, while in our own case the exports vastly exceed the imports, the excess of exports over imports in the ten months ending with October, 1900, being $499,667,936, or a greater excess than in the corresponding period of any preeding year and a greater excess than that of any other country of the world.

A most impressive showing of the growth of American commerce and of the wonderful balances in this country's favor during the last thirty years of the past century is found in an official report. Imports exceeded exports almost continuously prior to the decade 1871-80, and since that time exports have almost continuously exceeded imports, but the excess of exports over imports in the decade 1891-1900, is extremely large, as compared with any preceding decade, amounting to $2,615,343,320; while, as already shown, the excess of exports over imports in the single year 1900 will also be greater than in any preceding year in our history.



THE LLAMAS OF SOUTH AMERICA.

Used instead of horses to carry freight and other burdens over the mountains. They are docile.

ENORMOUS GOLD PRODUCTION.

Wonderful Record of 1900—What Is Expected in Year 1901—The United States Becoming the Greatest Gold-Producing Country in the World—Foreign Nations Seek Our Gold—Important Figures on Production.

THE following compressed story of the world's work in the gold fields is told in millions of dollars:

	1899.	1900.	1901.
United States	71	82	94
Canada	21	25	30
Mexico	8½	8½	8½
Africa	73	5	75
Australia	80	38	88
Russia	22	23	33
India	8½	8½	9
China	5½	4	4½
All others	17	18	23
	306½	257	365

The world's production of gold for the last decade of the present century, using the above semi-official estimate for 1900, is $2,106,195,000, as follows:

1891	$130,650,000	1896	$202,250,000
1892	146,300,000	1897	238,810,000
1893	157,500,000	1898	287,425,000
1894	181,000,000	1899	306,500,000
1895	198,760,000	1900	257,000,000

Compare this, the production of the world's standard money metal, with that of the preceding decades of this century:

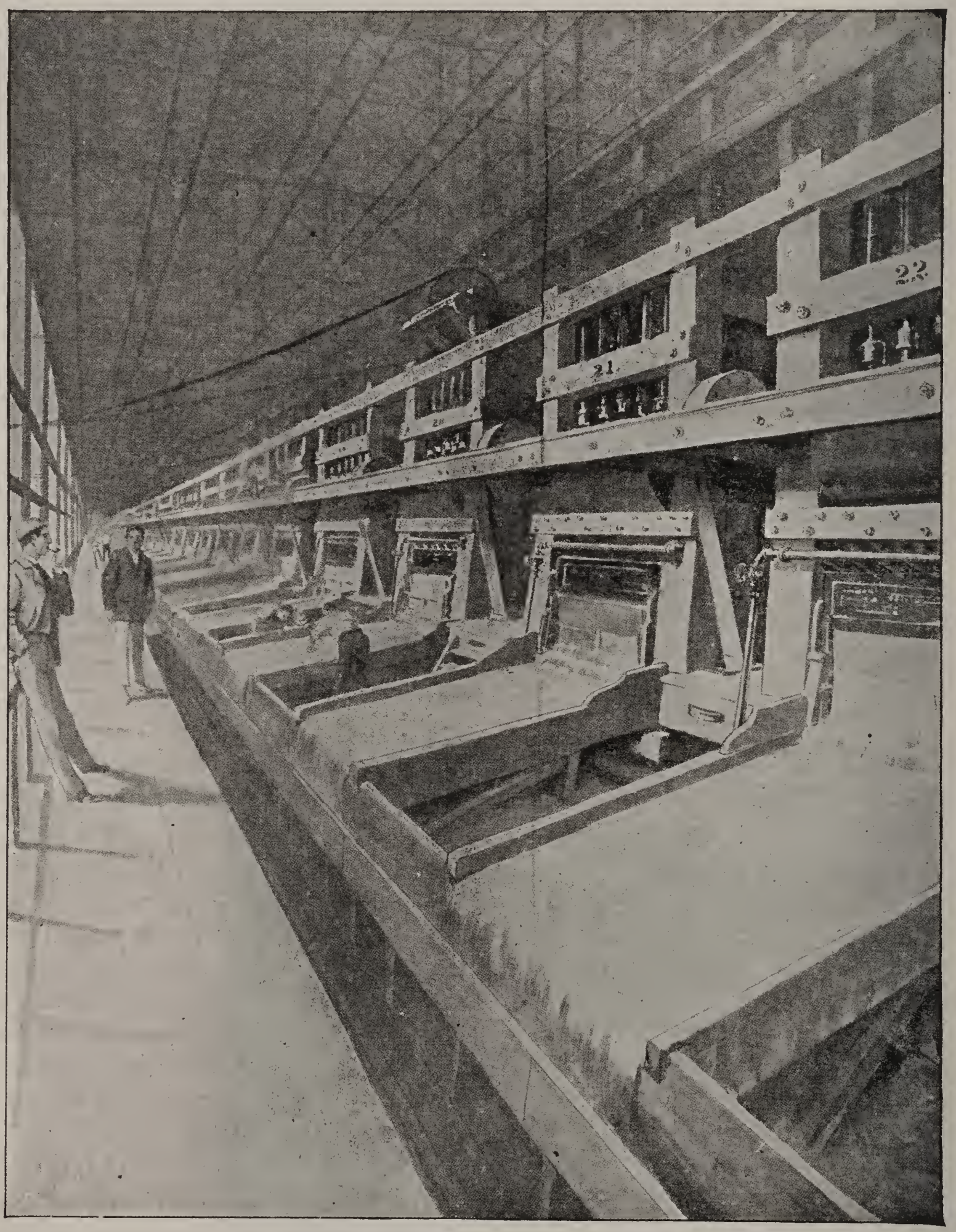
1891-1900	$ 2,106,195,000
1881-1890	1,059,892,000
1871-1880	1,150,854,000
1861-1870	1,263,015,000
1851-1860	1,332,981,000
1841-1850	363,928,000
1831-1840	134,841,000
1821-1830	94,479,000
1811-1820	76,063,000
1801-1810	118,152,000
Total	7,700,360,000



GOLD BRICKS OF THE ASSAY OFFICE VALUED AT $1,000,000.

With the first year of the new century starting out with an estimated increase of 20 per cent over the most productive year of the past, who can say to what colossal figures the gold output of the twentieth century may not run? And will the economists and statesmen of the future have to consider the problem of a new basic money or standard because gold has be-

come too plentiful and cheap? The United States is not only becoming the greatest gold producing country in the world (including Alaska our territory), but it is the country to which gold most naturally and freely flows by a law of commercial gravitation. Foreign nations have to replenish their gold supply by artificial means. Now that the finances of the United States are on a sound basis gold is flowing to America in a steady stream. It is a remarkable fact that 19,-



JOHANNESBURG GOLD MINE.

Showing stamp battery where the ore is crushed.

000,000 Australian coined sovereigns are now reposing in the government's vaults in this country. They were shipped straight from the Australian mints to the United States in payment of balances which Australia owed London and London owed this country.

It is also a fact that, commercially considered, nearly the entire gold output of North America belongs to the United States and contributes to our circulation and resources. In 1890, 45 per cent of the world's output was produced in North America, and in 1901, after the South African mines have resumed their activity, 35 per cent of the world's production will still come from the mines of the United States, Canada and Mexico.

Canada is coming forward with great strides as a gold producer, thanks to the Klondike region, and the Canadians are vigorously agitating the establishment of a Dominion mint. At the present time the United States coins are used as the basic money of the Dominion, for a bank reserve and the like. Canadians naturally feel that they want a basic coin of their own.

World's Production of Gold as Figured by the Director of United States Mint.

	1898.	1899.
United States	$64,500,000	$71,000,000
Canada	14,000,000	21,000,000
Mexico	8,500,000	8,500,000
Africa	80,000,000	73,000,000
Australia	65,000,000	80,000,000
Russia	25,500,000	22,000,000
India	8,500,000	8,500,000
China	6,000,000	5,500,000
All other	15,000,000	17,000,000
Totals	$287,000,000	$306,500,000

	1900.	1901.
United States	$82,000,000	$94,000,000
Canada	25,000,000	30,000,000
Mexico	8,500,000	8,500,000
Africa	5,000,000	75,000,000
Australia	83,000,000	88,000,000
Russia	23,000,000	33,000,000
India	8,500,000	9,000,000
China	4,000,000	4,500,000
All other	18,000,000	23,000,000
Totals	$257,000,000	$365,000,000



COPPER MINING BY HAND DRILLS IN THE MINES OF NORWAY.
A method replaced by machinery in this country.

GREAT STONE LATHE.

Cutting Stone Into Columns—Cheap Method of Work—Run by an Engine—Saving in Work.

LOOK at this immense block of granite and think of the amount of work that must be put upon it to convert it into a perfectly round, high-polished column. Then look at the companion picture taken only a few days later with the granite already reduced to cylindrical form ready for the polishing process. The machine which works this rapid transformation is the latest triumph in the industrial world. It is called a lathe, and the work that it has been doing since it was installed has demonstrated that it is a success. It renders possible of easy and inexpensive accomplishment construction that has heretofore been very difficult.

The lathe was built in Philadelphia, and has been installed in the granite quarries at Vinalhaven, Maine, where columns of many sizes are being turned out for the Cathedral of St. John the Divine, New York City. In fact, this machine was primarily conceived and built for the



THE GREAT STONE LATHE

With an immense stone pillar or column in the process of being shaped and polished, without hand cutting

special work called for by the plans for this great new cathedral of the metropolis, which is to have no less than thirty-two granite columns fifty-four feet long by six feet in diameter, which will weigh when completed 160 tons each. In addition to this it will have innumerable columns of smaller dimensions.

In length the lathe that will perform this work is eighty-six feet, and when in working-order it weighs 135 tons. It has swings 6 feet 6 inches by 60 feet long, and it has eight cutters. Each tool takes out a cut three inches deep, the entire eight cutters reducing the column twenty-four inches in diameter at one pass over the stone.

What It Does.

The block of granite in the illustration weighs 310 tons; it is 67 feet long, 8½ feet high by 7 feet wide. The piece of granite to be cut is rough hewn at the corners by hand, in order that it may be placed in the lathe. Once in the lathe it requires about six weeks to turn out a finished column, dressed and polished. The tool that does the cutting is a circular disk of steel seven-eighths of an inch in thickness and ten inches in diameter. It has a V-shaped cutting edge, and is wedged on the mandrel and held tightly by means of a lock-nut. When the tool is in operation it is set at an angle to the axis of the stone being dressed. The entire stone revolves, and as it does so it imparts a rotary motion to the cutting disks, which are forced into the stone by means of the feed screw.

In this manner the tool splinters off the rock to any required depth, leaving a roughly chipped surface. When this shaping process has been completed there is attached to the tool posts in the same manner as the cutting tools a cup-shaped device holding hardened steel shot, by which the rough polishing is done. The final polish is imparted to the columns in much the same manner, but powdered emory is used in this operation.

When one considers the length of the blocks of granite handled, the idea obtains that there must be many supports to hold the weight while the stone is under treatment, but the fact is the entire weight of the stone is held by head and tail chucks, there being no intermediate supports. This tells in a sentence the quality of the material used in the construction of the lathe itself. When in operation the lathe is run by a fifty horse-power engine. It makes one and three-fourths revolutions a minute at cutting speed, and three revolutions at polishing speed. When the belt is thrown off and the machine runs free, it runs for nearly a quarter of a minute, a fact which shows how well balanced it is. The lathe was first placed in operation in August, 1900.



FAMOUS STAGE SETTING FOR "THE SUNKEN BELL," AS PRESENTED BY E. H. SOTHERN AND VIRGINIA HARNED.
IT IS SAID TO BE THE MOST EFFECTIVE AND COMPLICATED STAGE SETTING IN EXISTENSE.

QUICK SILVER.

Mines Found In Texas—Ore Is a Brilliant Red Rock—Roasting the Ore—Miners Often Suffer.

NEWLY discovered quicksilver mines in Texas have begun to yield large quantities of the valuable mineral, which hitherto has been obtained only in California. The ore which yields quicksilver is a brilliant red rock known as cinnabar, and when of high purity is vermilion in color. This rock is the original source of the pigment known as vermilion. It is a compound of sulphur and quicksilver, and to obtain the latter the rock must be roasted to separate the sulphur. When this is done the mercury passes off in the form of gas, is collected and afterwards condensed. Then it flows out in a continuous stream like a pencil of molten silver.

The discovery of the veins in California came about by noticing the peculiar vermilion frescoing on the bodies of the native Indians, and learning where they obtained the pigment. Occasionally mercury is found in its pure state, as when a miner accidentally strikes his pick into a little cup or basin of the fluid. Miners suffer a great deal from the poisonous fumes of quicksilver, and must necessarily be very cleanly to avoid sickness, while many use strong lemon juice to counteract the bad effects.

SMUGGLING—HOW IT IS DONE.

Three Classes of Smugglers—Punishment Inflicted by Law—Methods of Offenders —How Guilt Is Detected.

ONE of the most clever frauds against which the United States Treasury Department has to protect itself is that of smuggling. Countless schemes have been originated and brought into play by which the government is beaten out of thousands of dollars in revenue annually. A great staff of detectives is employed constantly by the authorities, but despite their vigilance many persons succeed in getting dutiable goods through the ports. The day is past when the "low-lying rakish craft" of the yellow-covered story book engaged in the trade, and now it is the first-class liners which provide means of transportation for such law-breakers.

Strictly speaking, these smugglers may be divided into three classes. First, there is that host of honest, law-abiding, honorable men who return from foreign ports with many valuables, dutiable souvenirs

and goods which they have purchased. Most of these are in utter ignorance of such a thing as a customs law, and never think of it when they are bringing the goods home with them. They bought them abroad simply because they could get them cheaper than in America. These people are surprised and pained when the entrance of their purchases is challenged.

Willing to Defraud.

The second class includes those who are aware of the custom laws, but are willing to take a chance of saving a few dollars by the purchase of goods in foreign ports and smuggling them into this country. Evidently they believe such laws are a species of partisan legislation, and that it is perfectly justifiable that they should evade them.

The third class, which has the least followers, is comprised of what are known as "professional smugglers." This class attempts to do regularly and on a wholesale plan what the second class does perhaps once in a lifetime. The contraband articles of the first class are usually a bit of lace, a precious stone, a quantity of gloves or cosmetics which the possessor wants for future use. With the other it is a business pure and simple.

The punishment provided by law is severe. In addition to the confiscation of goods, both fine and imprisonment may follow. The task of detecting these offenders is very arduous. When five or six hundred passengers cross the gangplank of an ocean liner several revenue officers are stationed about the landing. They closely scrutinize the countenances of the passengers, and so well have they cultivated the art that even a quick glance of the eyes does not escape them if it has a meaning behind it.

Detecting Smuggling.

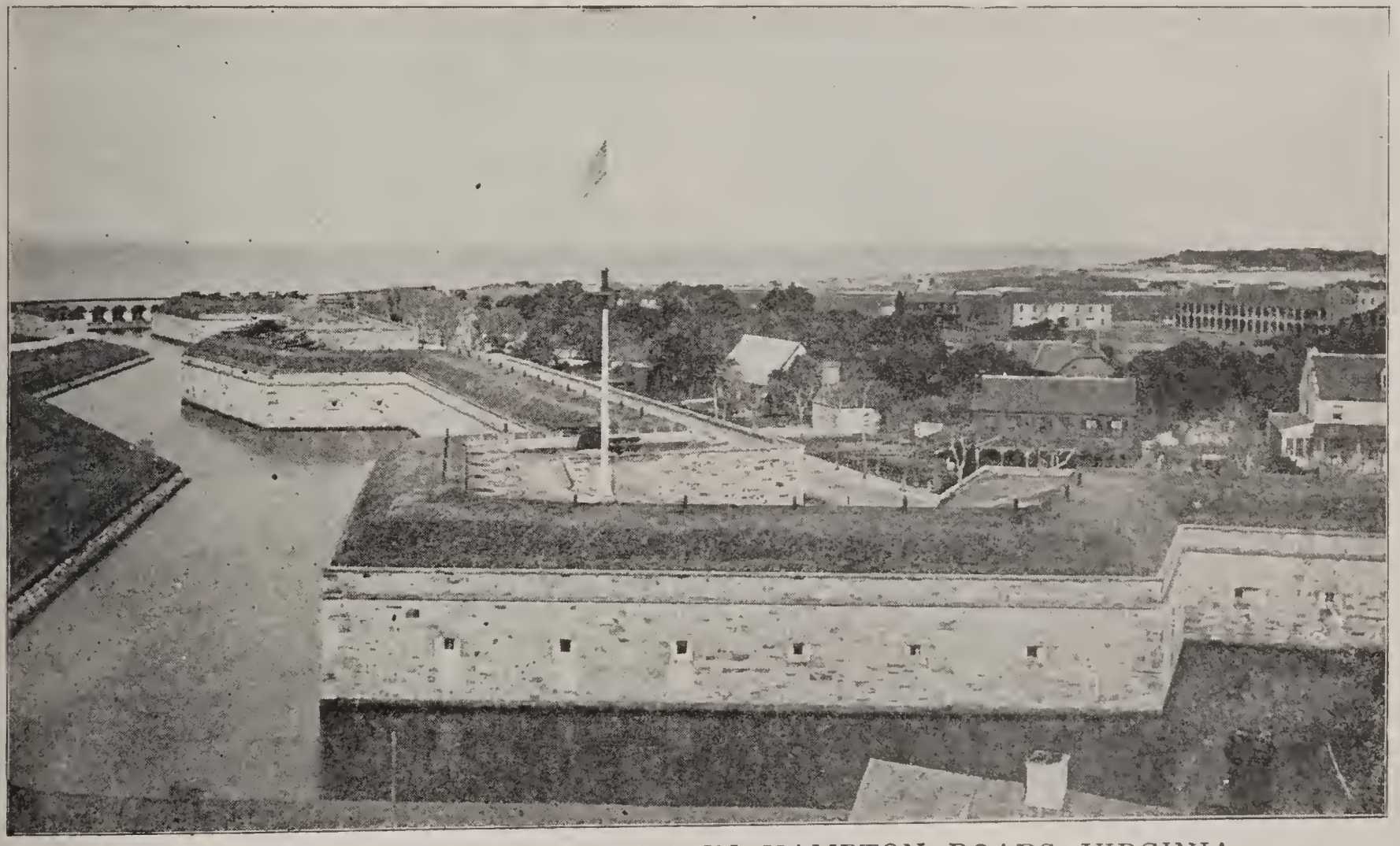
If a man descends with a slight swelling in his waistcoat pocket he may be intercepted and forced to submit to an investigation by the officers. Precious jewels are secreted in divers places on a man's person. In one case a double vest concealing many silver watches was detected. Another time a man was discovered to be much broader about the waist and chest than he really should be. Upon investigation it was found that several yards of very valuable lace were twined about him. Women are also great offenders. Costly jewels have been concealed by them in their bosoms, also laces and other valuables have been secreted on their person. In one instance a man was noticed to limp when descending the gang plank. He was searched, and a large diamond was found between his toes. False bottoms in trunks and telescopes also cause the government officials much trouble. Thousands of dollars worth of valuables have been found under layers in innocent-looking telescope trunks.

PATROLING THE OCEAN.

Work of the Hydrographic Office—The Skipper Recording Observations—Value of Bottles Cast Overboard.

THE ocean has become as minutely surveyed and in its elements as closely tabulated as the land. In its more traveled parts, and frequently in other parts it is being constantly and systematically observed and noted in all its winds, currents, temperatures, depths and obstructions, transient or permanent; and from the records thus obtained the shipmaster is able to lay out his course with great knowledge and precision.

On the wall of one of the rooms of the Hydrographic Office, in the Navy Department building at Washington, hangs a blank chart. It is a large blackboard on which are drawn in outline all the oceans of the world, with the continents which divide them traced between. The parallels of latitude and the meridians of longitude are shown. Starting at various points in the oceans and running over the surface are many irregular lines traced in chalk. At the end of



THE NEW FORTRESS MONROE, IN HAMPTON ROADS, VIRGINIA.

It is the largest of its kind in the world, although not up to date in defence.

each of these lines is stuck a pin, from which is hung a little green tag.

These tags and pins are removed at frequent intervals during the day by an official of the department, the corresponding outline is continued further across the chart and the pin and tag placed at the new termination of the line. On each tag is the name of a derelict vessel that is known to be floating free in the ocean, and the lines represent the course which the derelict has been pursuing, the tag marking the point at which she is reported to the office as having been seen last. On another chart hanging on another wall are lines indicating the tracks of bottles cast overboard and allowed to drift for the purpose of showing the trend of ocean currents. These lines are extended or amended according to information received by telegram or letter.

Other charts show the progress of cyclones, the position and drift of icebergs, the position of waterspouts, the temperature of surface water, the movements of the Gulf Stream, the peculiar aberrations in the audibility of fog signals, the growth of fog banks, the peculiar formation of clouds, etc.



THE EDDYSTONE LIGHTHOUSE.

Built on rock out in the ocean, off England's coast, and defying the powers of the waves and storm. The structure is made of steel.

Work of the Skipper.

When a vessel starts out on a voyage the Hydrographic Office furnishes the captain two small blank books containing forms to be filled in. There is a leaf for each day. One book is a general weather report, the other is a supplementary storm log. All observations are taken at Greenwich noon and recorded in these books. By means of his chronometer and by making observations, the seaman can calculate Greenwich noon to the moment. It is from these books that the daily chart of the ocean is prepared.

The questions asked concern the time of observations; the latitude and longitude; the true direction and force of the wind; the state of the barometer; the temperature of the air and of the surface water; the forms of clouds and the direction of their movements; the state of the waves and the direction in which they are running; the estimated current for

twenty-four hours; the weather experienced for twenty-four hours; the apparent periodic time, or intervals, in seconds, between the crests of successive waves as they pass; the true direction from which they come, and the ship's true course and speed at the time; the estimated heights of the several waves, from hollow to crest; the depth of the sea where the observations are made, or at least the exact position of the ship so that the depth may be obtained; information concerning fogs; general description of electric phenomena, and any experience in using oil to prevent heavy seas from breaking on the vessel. In the books are diagrams in which the captain may indicate the exact position of clouds and their height above the horizon.

These books reaching the Hydrographic Office, the reports for each day are grouped and collated, and the balances and averages thus set down on a chart. Captains of vessels are also provided with a number of bottles with a printed form for each covering the time and place at which the bottle is cast overboard. Blanks are left for the entry of the time and place the bottle is recovered, if at all.



FORTIFICATIONS OF GIBRALTAR AT THE BASE OF THE GREAT ROCK.

These have been built by England, and not only guard the rock but the entrance to the Mediterranean. Gibraltar is supposed to be impregnable.

These bottles prove one of the most fruitful sources of information to the Hydrographic Office.

Derelicts and Icebergs.

A computation made by the Hydrographic Office shows that 1,628 derelicts were sighted upon the North Atlantic ocean within a period of seven years. Of this number 482 were identified. The average number sighted is 232 a year.

or nearly twenty a month. In 1893, 413 were sighted, an average of thirty-five a month. As the average term of survival for a derelict is one month, it is estimated that at least nineteen must be constantly floating over the North Atlantic Ocean. There are more derelicts sighted during September, October and November than during other months of the year.

The charts show that most of the derelicts have been sighted in the Gulf Stream off the coast of the United States north of 30 degrees north latitude and west of 60 degrees west longitude. The number gradually decreases toward the eastward, along the routes of transatlantic steamers. About fifty ocean-going vessels are known to have collided with derelicts in the North Atlantic within a period of seven years.

Icebergs are a menace at sea, there being danger of colliding with them at night. According to observations made by the Hydrographic Office great accessions of icebergs come in cycles, there being years during which few or none are sighted, and again years when the number is great. From 1891 to 1895 numerous icebergs were sighted, and also during the year 1898. Waterspouts are a source of danger at sea. Specifically, a waterspout is a whirlwind over a body of water, producing the appearance of a solid column of water extending from the surface to the clouds. In reality, the phenomenon that is seen is the cloud brought down to the earth's surface by the rapid gyratory motion of a vertical whirl. At first the cloud has the form of a tapering funnel, but as it descends near the water's surface it draws up the water for a distance and imparts to it its whirling motion. The height of the spout depends upon the hygrometic state of the air; in general it is between 800 and 2,500 feet. Waterspouts are most frequent in tropical and equatorial regions.



SHIPS AND ICEBERGS

NIAGARA FALLS.

Beauty of the Falls in Winter—Will Have Disappeared in Two Thousand Years—Annual Horse Power.

ICE forms at Niagara Falls each winter 100 feet thick. Much has been said about the wonders and impressive solemnity of the falls in the summer months, but to realize the great works of nature at that spot one must visit the world-renowned spectacle in the winter. When the thermometer is below zero is the time to visit one of the greatest sights in the world. The rocks, the trees, the shrubs, have all disappeared, and in their stead one finds monstrous ice formations, trees staggering under the weight of massive collections of frozen vapor, and rocks which present the appearance of small ice-clad mountains.

Regardless of the scenic effect the famous ice bridges of Niagara are the most interesting features of a visit to the falls. Weeks of severe cold weather are accountable for the formation of these bridges. The ice in Lake Erie flows down with the current in great bodies after it melts from the effects of a few days of sun. As it reaches the river its speed is accelerated. Then it reaches the current proper, and is hurled through the rapids at marvelous speed.

When large floes come down the river the ice gathers in great quantities on the reefs and bars above the falls. In many winters the direction of the current of the stream has been diverted entirely. Sometimes it is made possible for persons to cross on the ice formations, and points which are seldom accessible on other occa-

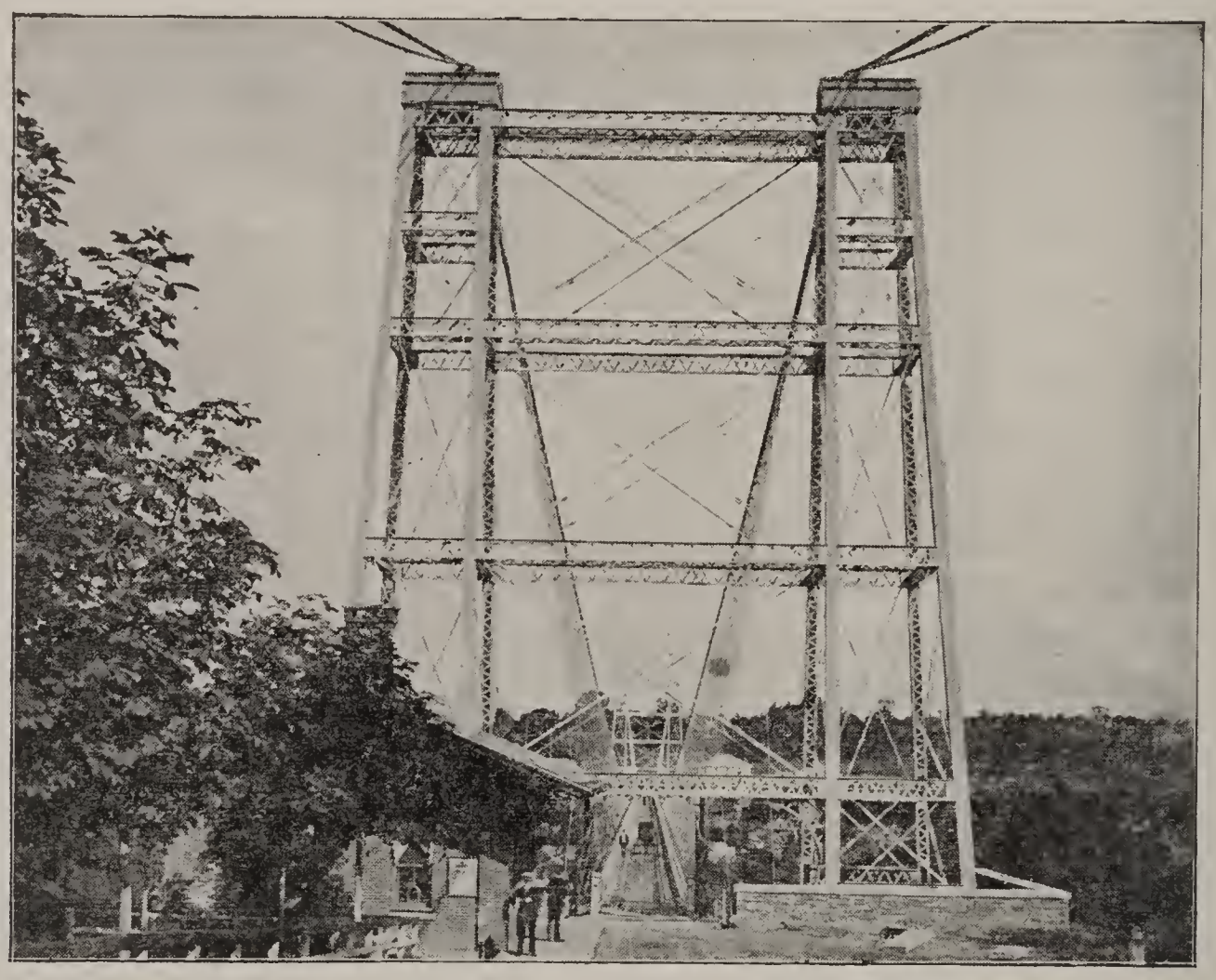


NIAGARA SUSPENSION BRIDGE.

Looking up from the river which itself comes from the famous falls.

sions have been reached by crossing on the ice bridges. At one time the ice formations so completely interfered with the flow of the stream that the water in the Niagara River was reduced to half its original depth. It remained so for a few days, when the formation broke and the water came rushing down again.

Persons watch for days the formation of these bridges in hopes of being the first to cross. It is a dangerous feat, but is risked by many. These feats are heralded all over the country, and the name of the first to cross the new bridge is recorded throughout the adjacent towns. In some instances, horses are known to have crossed from the Canadian to the American side in safety.



THE FAMOUS CANTILEVER BRIDGE OF NIAGARA FALLS.
Showing the American entrance and guard's cottage.

Falls Slowly Receding.

Niagara Falls were discovered in 1678. They have receded in the last 175 years 76 feet from where they originally were. Their height at the American falls is 164 feet, at the Horseshoe 158 feet. The average recession of the falls or breaking away of the rocky front over which it dashes is about 2.5 feet per year. Below the falls the descent of the river is 15 feet per mile. Their width at the American falls is 600 feet, at the Horseshoe 1,800 feet. The amount of water which passes over them is 270,000 cubic feet per second. They receive their entire water supply from the Great Lakes and the water sheds about them.

Scientists have calculated that at the present rate at which the falls are crumbling away they will pass out of existence in about 2,000 years. They are now used extensively for the development of electrical horse power. Electrical works have been erected at the base of the falls for the development of horse power. It is estimated that 8,000 horse power per year is thus secured. This is distributed

to neighboring cities and sold on the basis of $25 per horse power per year. In connection with the formation of the falls, geologists have discovered that at one time the waters of the Great Lakes flowed into the Mississippi River and the falls did not exist. Subsequent upheaval of the earth created the continental divide at Summit, twelve miles from Chicago, and after that the waters of the Great Lakes worked their way eastward and formed the famous falls.

PROVISIONING AN OCEAN LINER.

Capacity of Modern Ocean Liner—Game in Great Demand—Jellies and Sweets Consumed.

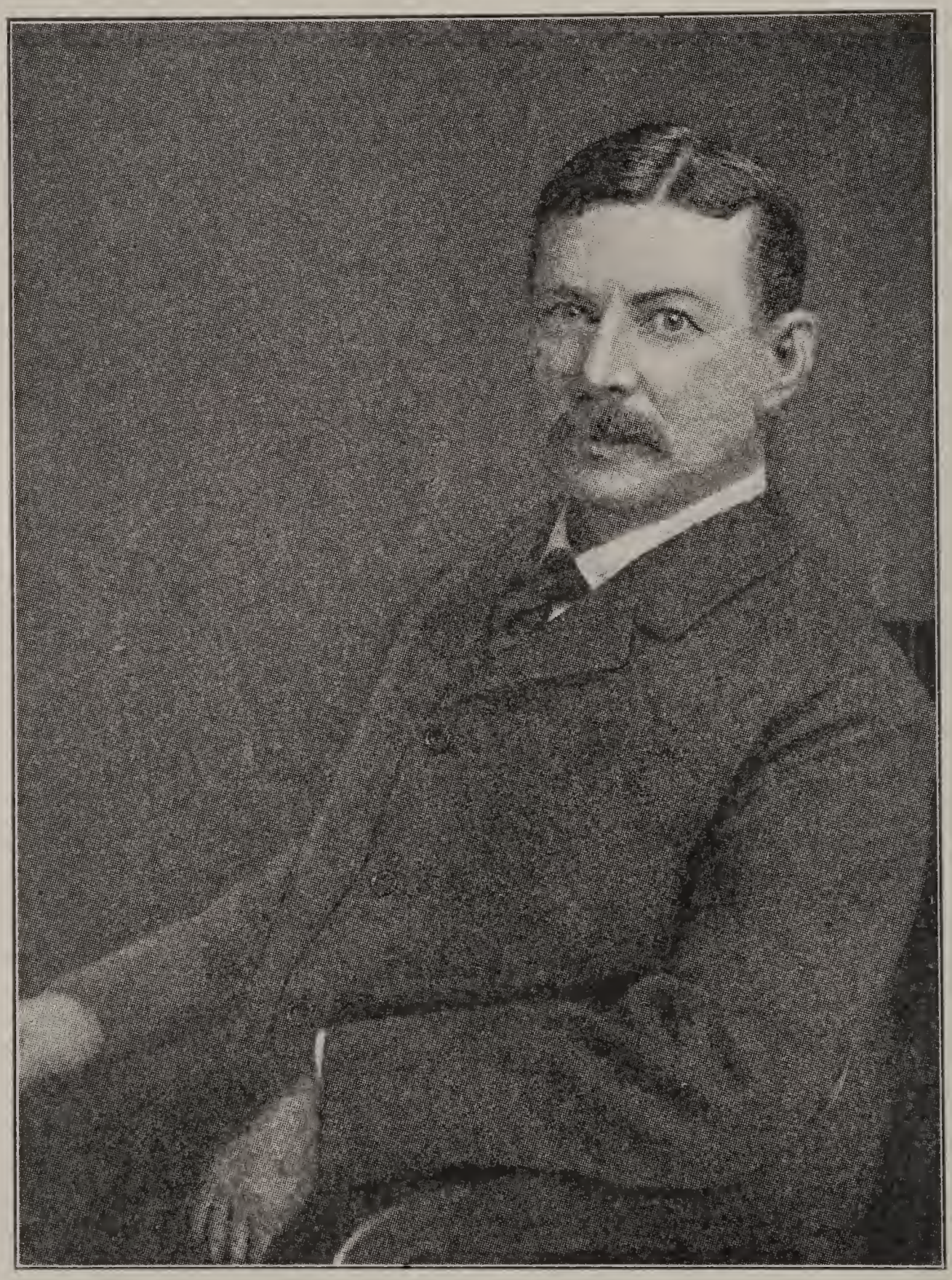
PROVISIONING an ocean liner of the modern type is one of the greatest wonders of twentieth century steamship transportation. It would be impossible for an uninformed person to estimate the amount of provisions which must be put into one of these vessels for a round trip from the United States to Europe, covering a period of twelve days—six over and six back. Before trying to make any calculations the number of passengers carried by one of these sea monsters must be considered. Taking one of the most modern type as a criterion, the following facts and figures will give the reader some idea of the magnitude of the enterprise. The passenger capacity of one of these floating palaces is usually 2,000 persons, not including the crew and other employés attached to the vessel. She will carry 350 saloon passengers, 275 second cabin, and 1,000 third class, with a crew of about 450, 150 of whom will be in the steward's department. So much for its capacity for human freight.

The amount of bread consumed on a voyage is startling. The total amount of flour stored for bread and pastry is 200 barrels. As the gross weight of a barrel is 220 pounds, the weight of this alone is 39,200 pounds or 17½ tons. Meat is also a great factor in an Atlantic trip. In the old days live stock was carried and killed as needed for the table. But since the process of cold storage has been successfully demonstrated it has done away with the old custom and saved much needed space. Great refrigerators are provided which will keep in first-class condition thousands of pounds of fresh meats for several days. In these compartments are stored 20,000 pounds of fresh beef, 10,000 pounds of mutton, 14,000 pounds of lamb, 500 pounds of veal, and 500 pounds of pork.

Game in Demand.

The demand for game in season, especially among first cabin passengers, is enormous. To provide for this the steamship company lays in a stock which far exceeds that of the greatest hotels in the country. The capacity for poultry and game is 5,070, apportioned as follows: 1,500 spring chickens, 500 capons, 200 roasting chickens, 300 fowls, 500 duck-

lings, 50 goslings, 120 turkeys, 200 pheasants, 300 partridges, 800 squabs, and 600 quail. This amount is consumed chiefly by the saloon, second cabin passengers and superior officers, so the supply is abundant. These solid comestibles are, however, flanked by large quantities of toothsome fish; 3,000 pounds of fresh fish of various kinds are provided, besides 2,500 pounds of salt fish. The herring is also in great demand, and 30 barrels of these—15,000 in number—are in the refrigerators. Besides these are 50 boxes of smoked fish, 500 pounds of lobsters, 400 tins of sardines, 500 pounds of turtle, 20,000 oysters, 10,000 clams.



WILLIAM H. MOODY
SECRETARY OF THE NAVY

Eggs are consumed to the number of 25,000. If a hen should lay one egg every

day in the year, in order to furnish enough for a ten-day trip, she would continue to lay at that rate until 1967. This number of eggs represents the combined annual output of 277 hens. A trifle over 2,500 pounds of oatmeal is carried on a trip. Most of this goes to the steerage passengers. Of ham and bacon, 5,000 pounds—more than two tons—are necessary to appease the appetites of lovers of such food.

Butter, jams, jellies and marmalades cut a great figure in provisioning a vessel. The total amount of butter taken on for a voyage is 5,000 pounds. Despite seasickness, 5,000 pounds of jams, jellies, and marmalades find their way to the table in various forms. Ten thousand pounds of

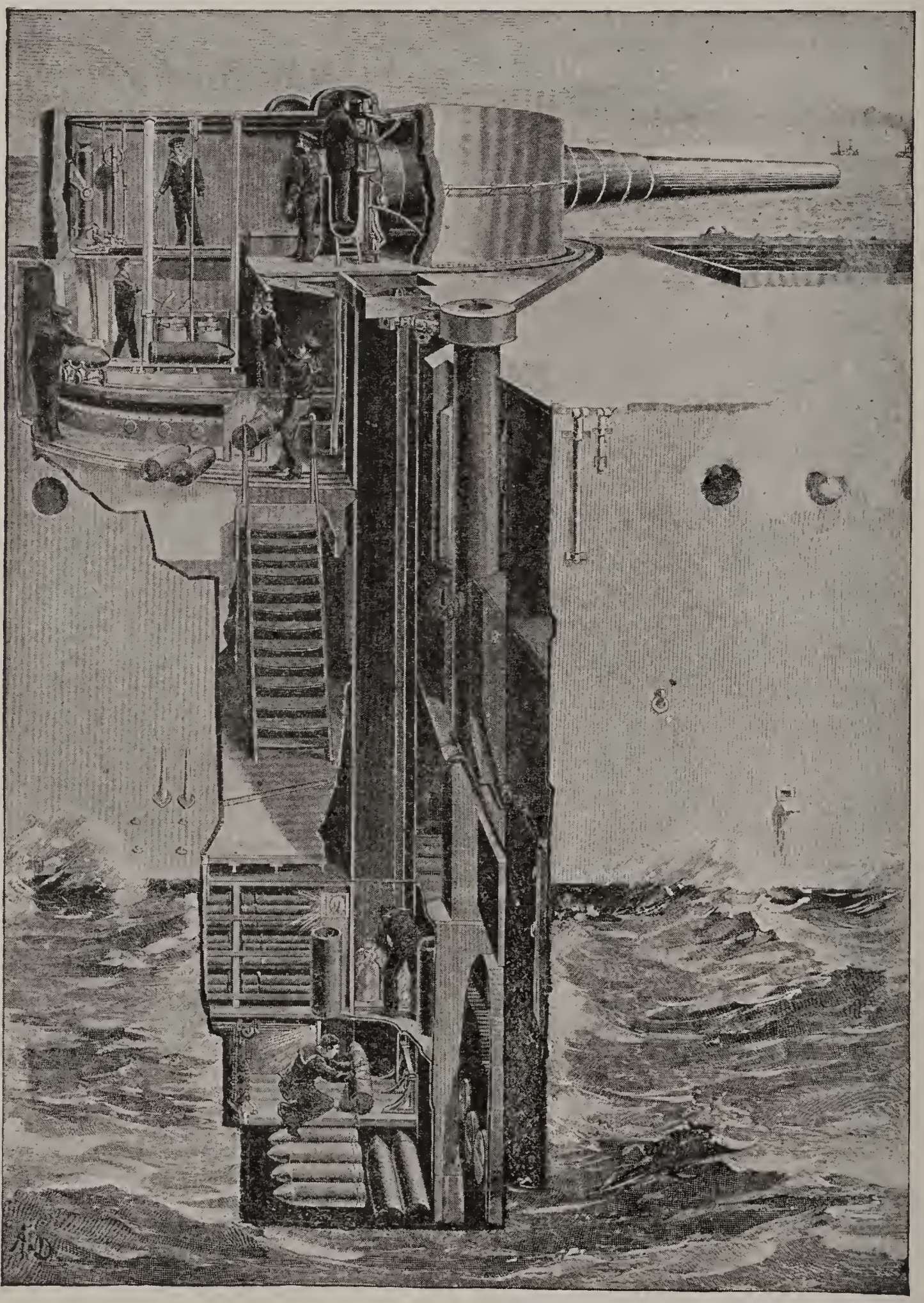


EUGENE HALE OF MAINE.
Chairman of the Senate Committee on Naval Affairs.

sugar, or nearly 4½ tons, go to sweeten edibles and drinks to the tastes of the passengers. Two thousand five hundred pounds of coffee and 1,500 pounds of tea are laid in store for the round voyage.

Amount of Milk Consumed.

A small lake of milk is always on hand. The steward provides 800 gallons of the liquid, which is put through a sterilizing process in order that it will not sour on



SECTIONAL VIEW OF A BATTLESHIP, SHOWING TURRET AND AMMUNITION HOIST.

the trip. In the old days immigrants and other passengers suffered from scurvy and other diseases owing to a want of vegetables. This has been overcome as provisions are now made by which such perishable goods are preserved for days. Forty-six tons of potatoes form another important factor in the domain of the steward.

There are 250 coffee and tea pots, 100 butter dishes, 200 sugar basins, 250 vegetable and entrée dishes, 10,000 pieces of china, for first and second class passengers, and 3,600 plates and 1,500 cups for third class use. In the course of the year—about ten round voyages—the principal items of provisioning would total up as follows: 62,000 pounds of butcher's meat, 50,700 poultry and game, 200,000 oysters, 250,000 eggs, 15,000 pounds of tea, 25,000 pounds of coffee, 200,000 oranges, 50,000 pounds of butter, and 2,000 barrels of flour.

COST OF A NATIONAL ELECTION.

The National Committee a Business Organization—Collection and Disbursement of Funds—Amount of Money Expended.

IT cost $600 to nominate Abraham Lincoln for President, and $7,000,000 to elect William McKinley President of the United States. These figures represent the growth of political campaigning in thirty-six years into a great business with a perfect system of organization. The total expenses of a political campaign in which a President and high State officers are elected exceed the entire cost of the federal government for the first few years of its existence. Chairman Gorman of Maryland and Senator Quay of Pennsylvania are the men who, as chairmen of the national executive campaign committees of the democratic and republican parties in 1884, introduced into American politics the present system of conducting national campaigns by means of thorough organizations throughout the country and the expenditure of vast sums for speakers, literature, music, and other spectacular features.

The business affairs of the great political parties are intrusted to national committees, composed of one member from each State and Territory, who are elected by the delegates to the national conventions at the time the conventions are held. The chairman of the committee is always the choice of the nominee for President, and in the power of this chairman rests the entire campaign.

National headquarters are opened soon after the candidates are nominated. Committees are appointed, and the principal work—that of getting money—is begun immediately. Circular and personal letters are sent out to strong men and great corporations. Many of these corporations contribute to both funds, so that they may have supporters no matter which party is elected. Because of the civil service regulation no money is supposed to be raised by assessment. Everything is given as a donation, in theory at least. No books are kept, and the ex-

penditures are known only to the chairman of the committee. The bulk of the money, however, is turned over to the treasurer.

a staff of expert political writers is employed to compile facts and figures from the records of Congress. The greatest book or publication is the text book.



SENATOR M. A. HANNA.
Chairman of the Republican National Committee, 1896 and 1900.

Providing Literature.

The greatest task before campaign managers after the headquarters are opened is that of providing literature. Much stuff is submitted by outsiders, but This contains many arguments in favor of the party, and also much information upon which speakers base their addresses. Over one million of these are printed by each party within a month. More than $250,000 is spent in printing this literature

for one party, and the cost of distribution is equally as much.

Another department under the supervision of the chairman of the national committee is the "speakers' bureau." Many prominent senators, congressmen, and other politicians of note volunteer their services to the cause for a number of speeches wherever the party desires them to go. They receive no compensation, but the headquarters stand for their traveling expenses. Then there is what is known as "spellbinders." These are paid to make speeches, their salaries ranging from $500 a speech to $100 per week. Their speeches are usually censored before delivered. An army of orators is in telegraphic communication with headquarters daily. They report how they were received at towns along the road and other incidents which may prove of interest to the managers.

Handling the Press.

There is the press committee. This deals with editors of small papers who demand a compensation for their support of the party. They come into the office, state the circulation and influence of their paper, and offer to give the party advertising and support for a fixed sum paid in advance. After a little talk, this is granted if the price, which is five or six times regular advertising rates, is not too great.

By August all these preparations have been completed. The "straw" calculations are then made. Experts and canvassers are employed in all districts to find how the voters stand. If favorable to the cause pamphlets are published stating the number of votes "which will be cast on election day." These are not merely guesses, but are compiled with great accuracy. If unfavorable districts are reported the work of the committee is doubled in that doubtful territory.

When the party has money on hand the expenditures of a day amount to more than $50,000. Besides this amount an emergency fund is put away by the chairman of each national committee, the amount of which only the chairman knows. This sum amounts sometimes to $50,000,000, and other times $1,000,000. A secret service system is also part of the great organization. Special detectives are hired to find out the condition of doubtful districts, and reports are made to headquarters. The money expended by the national committee is but a small part of the expenses of State campaigns and elections throughout the country. In the larger States each party organization spends from $100,000 upwards to $1,000,000 working for the election of the State ticket. The expenditures in large cities are enormous, and the expenses of thousands of candidates throughout the country cannot be ascertained. The cost of the political campaign of 1900 is reckoned at about $25,000,000. The major portion of the cost is borne by people who live or profit by the business of politics.

THE BIGGEST BIRD THAT FLIES.

Attains the Greatest Heights Possible—Carnivorous Appetite—Keen Power of Sight—Other Big Birds.

THE ornithologists of Great Britain and America have decided that the largest bird that flies is an American bird, the great condor of the Andes. To another bird, which is American now, has been given the second prize. It is the fierce, harpy eagle of the Philippines. Our own turkey comes near the second place, and if England succeeds in her attempt at reintroducing the famous great bustard into the tight little island, it will have the next largest bird to our turkey.

In the United States we have, besides the turkey, four other birds which are ranked high in the list of the largest flying birds. They are the beautiful golden eagle, the national bald-headed eagle, the great wild swan, known specifically as the whooper, and the California condor, which is almost as large as his South American brother. In many respects the South American condor is the most remarkable of all living creatures. No other bird can fly so high. Humboldt saw one flying over Chimborazo at a height of over 23,000 feet. It seems to fly as easily and breathe as easily in the rarefied atmosphere at that great height as it does at the level of the sea. No other created being can do this, as no other living creature can lift itself so far above the earth. When flying, it sails in majestic circles or hangs poised in the air as if suspended there by an invisible cord.

Darwin once watched a condor for half an hour as it hung over an Andean valley, and never once did he detect the slightest movement in the great bird or its widespread pinions. Its home is above the snow line, and it chooses as its favorite dwelling places where great cliffs descend sheer down for thousands of feet. It wanders sometimes to where the cliffs of Patagonia frown over the troubled seas, but prefers to seek its food in the mountain valleys. It is a bird blessed with an appetite as remarkable as itself, and one condor has been known to devour a calf, a dog, and a sheep in a single week. On the other hand, it can go without food for more than forty days.

Keen Power of Sight.

Probably no other created animal has such keen sight as the condor. From tremendous heights and from great distances it can spy a carcass, and will swoop down on it with the rush and speed of the wind sweeping through the mountain gorges. Though a good-sized condor measures fifteen feet in its expanse of wing—condors have been shot with that spread—there seems to be no authentic record of the weight of a condor of that size. The weight of the bird is estimated by good authorities, however, at about forty pounds for one with a fifteen-foot spread of wing.

In putting forward the claims of the

turkey to be the third largest bird that flies, if not the second, the tame as well as the wild bird must be taken into consideration, for the domestic turkey certainly can fly, and sometimes ascends to the "tipmost top of the tallmost trees," though it is not so lively on the wing as its wild brother. Benjamin Franklin wanted to have the turkey adopted as the national bird of the United States instead of the eagle, and made out a good case for the bird as against the claims of his successful rival. Why the bird in question is call a turkey has been much discussed without reaching any definite conclusion. One theory is that the turkey names himself by his peculiar "cluck," which sounds like "turk, turk, turk."

Weight of Eagles.

There is a splendid specimen of the harpy eagle in the Washington Zoological Park, which weighs between twenty-eight and thirty pounds. When it is considered that the golden eagle weighs only twelve pounds, the sea eagle only sixteen pounds, and the Spanish imperial eagle only a little over ten pounds, it will be seen that the harpy undoubtedly is entitled to be considered the largest of eagles, if not the second largest of flying birds. No measurements which can be accepted as exact scientific records have been taken by the ornithologists of the length of body and spread of wing of this great and fierce bird, but it is established that the bird has a spread of at least ten to twelve feet.

There are those who not only demand second place for the bustard, but are inclined to give him first place among the birds that fly. Even such an eminent authority as J. E. Harting, of London, seems to incline that way. But the biggest bustard Mr. Harting cites is the Seville bustard, with a weight of thirty pounds, and the biggest authentic spread of wings he cites is only seven feet three inches. The German naturalist, the younger Naumann, tells of bustards weighing thirty-two pounds, and says that he has been assured of the former existence of specimens of the bird weighing thirty-five or thirty-eight pounds.

In speaking of big flying birds, the wild swan should not be forgotten. This bird sometimes attains to a weight of twenty-five pounds, and has an expanse of wing of seven feet. The albatross sometimes weighs seventeen pounds, and has fourteen feet expanse of wing. The laemmergeier, the great bearded vulture of the Alps, is the bird told of most frequently in song and story as a kidnapper. As a matter of fact, it is doubted by the best authorities if the laemmergeier ever stoops to any but a carcass.



THE HAWAIIAN ISLANDS.

Beautiful Scenic Effects in the Islands—A Famous Precipice—Natives Believe in Education—Growth of the System.

THESE beautiful islands, the "Paradise of the Pacific," are located about 2,000 miles from California, nearly in the center of the Pacific Ocean, and just on the edge of the tropics. Enjoying, as they do, the combined advantages of the tropic and temperate zones, the climate is ideal—in fact, the absence of extremes of heat or cold is so noticeable that the natives have no word meaning weather. The climate is so mild and the soil so fertile that one writer says:

"One could live there yearly an existence of charming idleness upon the capital expended monthly in the cold latitudes of the United States for ordinary comfort."

There is little incentive to actual toil. So easy is life that it may easily become too easy. There are eight inhabited islands in the group, and a total area of nearly 7,000 square miles, the population numbering over 100,000. Honolulu, the capital, situated on the island of Oahu, has about 30,000 inhabitants, and is a city of great beauty. It has wide streets lined with palms, handsome residences embowered in trees, beautiful gardens filled with rare, strange plants, blocks of business buildings of the latest architecture, and all the accessories of modern civilization—gas, electric lights, street cars, schools, hospitals and public buildings. Honolulu, under the American flag and the influence of our social customs, is the most charming residence place in the world. The principal points of interest in the vicinity of Honolulu are:

Punch Bowl Hill, an extinct crater about twenty miles distant from the hotel, from whose summit, some five hundred feet above the sea level, can be seen all the surrounding country from Waikiki to Pearl Lochs, Diamond Head, the Waianae Mountains and Kapiolani Park, forming a beautiful panorama.

Mount Tantalus, in the rear of Punch Bowl Hill, rises 2,000 feet, and here are obtained the best possible views, embracing an area of more than fifty miles, and as the approaches to it are through beautiful groves, it is a most delightful trip. Continuing on to Mount Konahuanui, which is 4,000 feet in height, the eastern side of Oahu can be seen, also the Koolan villages and bay.

A Famous Precipice.

The Pali, a famous point, six and one-half miles distant from the hotel, can be reached easily either by carriage or saddle horse. It is some 1,200 feet above the sea level, ascending very gradually, with the mountains on either side lifting their peaks 3,000 feet high, and when the last hill has been reached the view is sublime; while to reach the summit one passes through a gorgeous array of ferns, plants

and shrubbery of all varieties known to the tropics. It was here that King Kamehameha took such terrible vengeance upon his foes, driving them over the edge of the precipice, a fall of 500 feet.

Waikiki, a fashionable seaside resort where many of the residents of Honolulu have their summer homes, is a charming spot and a favorite place for turf bathing and aquatic sports, for which the natives are famous.

Great interest has been manifested by educators in this country in the schools of Hawaii. Hawaii provides for education upon the principle that all classes, whether citizen or alien, are entitled, without condition, equally and alike to the benefits of state education; a principle that contemplates a single system of schools, with equal privileges, open and accessible to all. Following this up and developing a school system upon it there is already provided the Lahainaluna school of manual training; the Armstrong Institute, an association of teachers for the introduction of industrial work in the schools; a series of agricultural lectures for the benefit of all classes; a reform school, located at Waialee, having the use of 733 acres of ground; the Honolulu Normal and Training School; a summer school and kindergartens.

During the latter part of 1899 one twelve-room school and one three-room school were erected on the island of Oahu, twelve new school structures on Hawaii, one on Maui, an addition to the school on Kauai. The buildings are by no means as expensive as those erected in



HAWAIIAN CHILDREN IN BATHING.

A tropical foliage scene.

the United States, and as a rule have only from two to three rooms. The general school laws of the islands first came into effect in 1840, but were not of practical effect until after the Ricord legislation of 1846. The real development of the school system commenced in 1847 under Richard Armstrong, a son of Gen. S. C. Armstrong, famous in connection with Hampton Institute. Since his time, with many setbacks and many discouragements, the growth of the school system has been steadily upward and steadily toward American thought.

Inmates of Reform Schools.

The Honolulu High School is one of the institutions of the educational system which all Hawaiians feel proud of always. It is not accredited at any of the universities of the United States. The high school is especially adapted to the needs of those who speak the English language as a mother tongue. The royal school is being developed along the line of a polytechnic. In school statistics there is much of interest as to the character of the nationalties living in the island group. For instance, the number of inmates received in the reform school during 1898-1899 were 69. Of these 40 were Hawaiians, 8 part Hawaiians, 14 Portuguese, 2 Chinese, 1 Japanese, 2 American, 1 Italian, and 1 German.

The offenses for which they were committed were: Truancy, 26; larceny, 31; disobedience to parents, 4; assault and battery, 2; malicious injury, 2; accessory after fact, 1; vagrancy, 1; common nuisance, 1; and burglary, 1. The number of public schools in the islands are 141, private schools 48, making a total of 189. The number of male teachers are 192, and female 352; total, 544. The number of male pupils are 8,651, female 6,839; total, 15,490. Of these 11,436 are in the public schools. The nationality of the pupils attending school is:

Hawaiian	5,043
Part Hawaiian	2,721
American	601
British	213
German	337
Portuguese	3,882
Scandinavian	84
Japanese	1,141
Chinese	1,314
South Sea Islanders	30
Other foreigners	124

The people of Hawaii are proud of their school system, and what it has accomplished under disheartening circumstances.

DREDGING.

Various Kinds of Dredges—The Purpose of Each—Some of the Largest Dredges and their Capacities.

THE largest dredge in the world was invented in Chicago by Lindon Bates and is in use by nearly all foreign governments. Within the last few years great improvements have been made in dredges and dredging machines for excavating rock or earth below the surface of the water. The most common kinds are the clam-shell dredge, the dipper dredge, the continuous-bucket dredge and the suction dredge. Particularly adapted for excavations in very hard material like hard-pan and blasted rock are the dipper dredges. The clam-shell and bucket dredges work best in soft tenacious material like clay, and the suction dredge does especially good work in sand, silt and other soft material.

In 1899, in work on the Buffalo, N. Y., breakwater construction, was a clam-shell dredge of enormous proportions. Its bucket capacity was ten cubic yards, and it took material from a depth of from sixty to seventy feet under the water, when running full capacity, at the rate of 4,000 cubic yards a day. The bucket when empty weighed fifteen tons and held forty tons of clay. Its machinery was so powerful that it could handle one bucketful a minute under sixty-five feet of water.

Two large suction dredges have been employed on the New York Harbor improvements. They have steel hulls, and have force to pump sand through tubes at the rate of 40,000 tons an hour. The hoppers of each dredge have a capacity of 3,000 tons of wet sand. Each dredge measures 320 feet long, 47 feet 10 inches beam, 20 feet 6 inches deep; draft, loaded, 16 feet 4 inches. For pumping sand each dredge has two centrifugal pumps with sixteen-inch suction and delivery pipes, each pump being worked by triple expansion engines.

Enormous Bucket Dredge.

Employed at Karachi Port works, India, was a chain-bucket dredge 236 feet long, 42½ feet beam, 16 feet deep and of 1,250 ton hopper capacity. In Vladivostock harbor there was a chain-bucket dredge 162 feet long, 33 feet wide, 12½ feet deep. Its hull was of steel, and it could excavate 457 cubic yards of compact clay an hour. In work on the Volga River in Russia was a suction dredge made in two parts—to be worked combined as one large dredge, or separate. Each part was 216 feet long, 33⅓ feet wide, 9 feet deep and 4 feet 8 inches draught. They were propelled by electric power, and had a wonderful capacity. One of the largest dredges in America is a dipper dredge on the Great Lakes. It is 132 feet long, 42½ feet wide, 13½ feet deep, and has a dipper capacity of 8½ cubic yards. The weight of the dipper is

sixteen tons, and its capacity is from 5,000 to 6,000 cubic yards in a ten-hour day.

The Bates dredges, which have so far surpassed all others in size, were first used on Chicago's drainage canal. Later the English government used them, and then the Russian. That they were invented by an American is another evidence of the progress of this nation.

Oyster dredging is most extensively practiced in the Chesapeake Bay near Baltimore, Maryland. There the finest oyster feeding grounds of the world are found. Oysters are gathered by the use of a system of drag dredges which are dropped into the bed of the stream in which the oysters feed and grow, and then drawn along by the boat to which they are attached above. When they are loaded they are lifted to the surface and their contents dumped into the boat.

Government inspectors continually watch this work. Otherwise, through the carelessness or criminality of the oyster dredgers, the oyster itself would soon be exterminated. These government inspectors compel the dredge men to return to the waters oysters which have not reached a certain age. There are certain months in the year during which the dredging is not permitted, and the government patrols the oyster feeding ground with boats on which cannon are mounted.



OYSTER DREDGES AT THE WHARF, NEW ORLEANS.

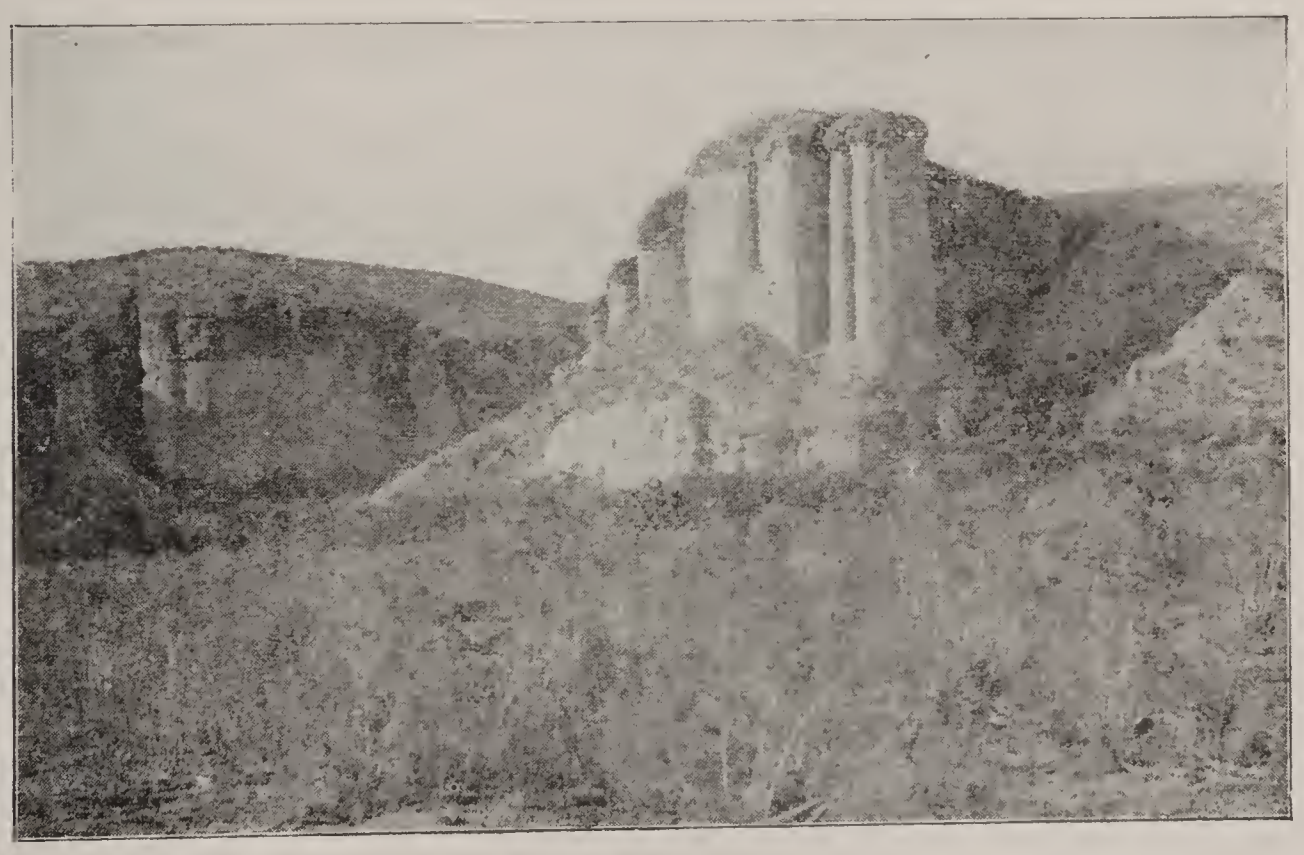
The Gulf Oysters are fatter and different in flavor from Chesapeake Bay varieties.

Body Dredging.

The police of all the large cities located on streams have a dredging system for recovering the bodies of people lost in the water. The most common term used for these dredges is "grapples." These grapples are strong iron hooks, weighted, and which are attached to long ropes. When thrown out of a boat they sink to the bottom of the stream. They are then drawn along in the expectation that their hooked ends will catch in the body of the lost person or the clothes, thus enabling it to be brought up. Despite the care with which the police dredge, most of the bodies lost in water are never recovered.

Gold dredging is a process used in the mining countries where the gold is not in quartz but in placer form, upon or near the surface of the ground, and loose. An iron bucket or dredge is run into this by hand or steam power, and the loose material taken up and deposited in running water. This water is so arranged that it separates the gold from the earth, carrying the earth away and depositing the gold in pans. Diamond dredging is of the same character, the water carrying off the blue earth in which the diamonds are found, and leaving the precious stones in sight.

Deep sea dredging is usually undertaken for the purpose of bringing up for naturalists the flora on the bottom of the ocean. This dredging is accomplished with great grapples, which are let down into the ocean to the depth of one or two miles, and when they come up the clinging seaweed and strange growths of the ocean bed are attached. By this method naturalists have mastered many of the secrets of the ocean.



BASALTIC ROCK FORMATION CAUSED BY WATER EROSION.
Marked examples found in the United States and Ireland.



BATTLESHIPS IN SAMOAN WATERS—NATIVE MERCHANTS TRADING FRUIT AND VEGETABLES

PETRIFIED FORESTS OF ARIZONA.

The most Remarkable in the World—Originally Composed of Firs—May Become a National Park.

THE most remarkable petrified forest in the world has been discovered in the northwestern part of Apache County, Arizona. According to geologists, the specimens found in this forest are the most wonderful of their kind in existence. Originally the forest was composed principally of fir trees It is eight miles square and is located on a plateau 5,500 feet above tide water, but the theory has been advanced that in its original state the woodland existed at a much higher altitude. The surroundings of the forest are especially desolate, nothing growing in that region save brush and soapweed.



THE GIANT'S CAUSEWAY.

North coast of Ireland. Natural rock formation created by water and fire. Ancient legends said that fabled giants used it for a path.

The greater part of the trees are completely petrified as far as the wood is con

cerned. They have an outer coating of sand and gravel which it is believed was formed by the action of the elements and by the movements of the trees at different periods in the world's history. The forest is extremely picturesque, but much of the scenic effect is destroyed by the barrenness of its surroundings. Geologists have advanced many theories for the petrification of the trees. One scientist claim that ages ago a volcano shower buried a number of forests in the southwest, and that the action of the water in later periods produced the necessary chemical action to change the woody matter into its present form. There is, however, little evidence of volcanic action in the region adjacent to the Arizona forest. Congress has been petitioned to set aside the land as a national park.

A WIRE THAT TALKS.

Mechanical Devices Used—Comparison with the Telephone—Method of Magnetizing the Wire—A Novel Invention.

THINK of a phonograph without a cylinder or diaphragm, a phonograph that simply strings its records on a piano wire, as you might file so many written sheets of paper. That is what a New Orleans electrician has invented. Its description is not difficult. When you talk over a telephone the vibrations of your voice send out a series of delicate electric waves. In the new machine a telephone is connected with an electro-magnet, which is excited by the little waves as they travel through it in infinitely rapid succession, and at the same time a long piece of piano wire is drawn past its two poles, very near, but not touching. This magnetizes the wire, but as the magnet itself is continually varying in power, owing to the vibrations, there is a corresponding variation in the effect it produces. That is, the wire is magnetized in different degrees all along its length, as if it were divided into millions of very thin disks, each of a separate magnetic power. These disks are your record.

For reproduction a mild electric current is sent through the magnet, and the same wire is again passed in front of the poles. The irregularly magnetized wire breaks the current into exactly the same kind of waves that were originally sent out from the telephone, and when an ordinary receiver is connected with it you hear a reproduction of the voice just as it is heard over the telephone.



BRIDGE OVER THE FIRTH OF FORTH, SCOTLAND

THIS BRIDGE IS CONSTRUCTED ON THE PRINCIPLE OF THE CANTILEVER BRIDGE AND CONSISTS OF TWO MAIN SPANS OF 1700 FEET. THE TOTAL LENGTH EACH OF THE VIADUCT, INCLUDING PIERS, IS 8296 FEET. IT IS ONE OF THE GREATEST TRIUMPHS OF ENGINEERING SKILL IN MODERN TIMES

Teaching a Child to Speak.

Periods of Development—What Sounds Express—The Child Learning Words and their Meanings—Use of Imitative Words.

PROFESSOR WUNDT, the German psychologist, has published his theory of the development of speech in children. In this development he distinguishes three periods. The first extends over the first five or six weeks of the infant's life, during which it utters only inarticulate vowel sounds or cries. In the beginning these cries always indicate cold, hunger, or sharp pain, but before the end of the first week they are called forth also by slighter causes, such as an uncomfortable position.

In another month the child begins to cry from impatience and weariness, and the first utterance of cries of pleasure dates from the same time. Gradually the cries become more varied and semi-articulate sounds like "ar," "ro," and "ka" are heard. Such sounds form a transition to the second stage of development, that of articulate sounds, which rapidly increase in number and variety. Combinations like "am," "ab," "na," and bu" are used to express a feeling of passive comfort and enjoyment of life.

Keener pleasure finds utterance in a loud crowing sound, which differs from the cry of pain by its higher pitch and shorter duration. There is little further change during the first year. New combinations are added, but they have not the character of words of definite meaning, but are simply expressions of states of feeling like the simple cries that preceded them. The same remark applies to the repeated syllables "ba ba," etc., which usually are developed in the latter half of the first year. These are usually expressive of perfect physical comfort, which seems to produce a sensation of rhythm. About the end of the first year the child usually begins to imitate sounds that it hears, and especially words.

Tendency to Echo.

This tendency to echo sounds varies greatly in different children. At first the sounds are simply repeated without any meaning being attached to them. But the child gradually learns the meaning of words, and soon begins to use them of its own accord to designate objects.

Then it has entered on the third stage, and has become a real student of language. It calls its parents "mamma" and "papa," and has names for all the persons and things of its daily environment. From this point progress is usually very rapid. A girl who first uttered a word, with an understanding of its meaning, in her twelfth month, had acquired sixty-six words in the nineteenth and seventy-eight in the twentieth month.

The speech of a child up to the third year, or later, is full of almost unrecog-

nizable corruptions and of reduplications which correspond with the stage of development of its ideas and form a sort of universal language, for they differ little in different countries. But the use of imitative words like "bow-wow" for a dog varies greatly. Here are a few Japanese words of this sort that are readily intelligible:

"Wan-wan" (dog), "nva-nva" (cat), "ko-ke-kio" (nightingale), "sion-sion" (sparrow), "bun-bun" (bee), "gou-gou" (a large bell), "goro-goro" (thunder), and" fu-fu" (fire).



SUGGESTIONS FOR TEACHING CHILDREN FACIAL EXPRESSIONS

ELEVATED ROAD SPEED.

Hopes They May Run Two Hundred Miles an Hour Yet—Description of the Beecher System—High Record of Steam—A Train of One Coach.

THE possibility of running elevated trains at the rate of one hundred and even two hundred miles an hour for long distances is said to be near. Millions of dollars have been spent by inventors in trying to find the secret of the "single rail" in railroading. The three systems which have attracted the most attention, and which are said to possess the greatest merits, are the Brott, the Beecher and the Boynton.

The Beecher system has been before the public more or less prominently since 1898, and it is believed by many practical men of this enlightened age that before many years it will be no uncommon thing to leave New York after lunch and reach Chicago—one thousand miles away—in time for dinner. The demands for time-lessening railway runs are increasing every year.



NEW YORK OR MANHATTAN ELEVATED ROAD AS IT APPROACHES THE BATTERY, NEW YORK HARBOR.

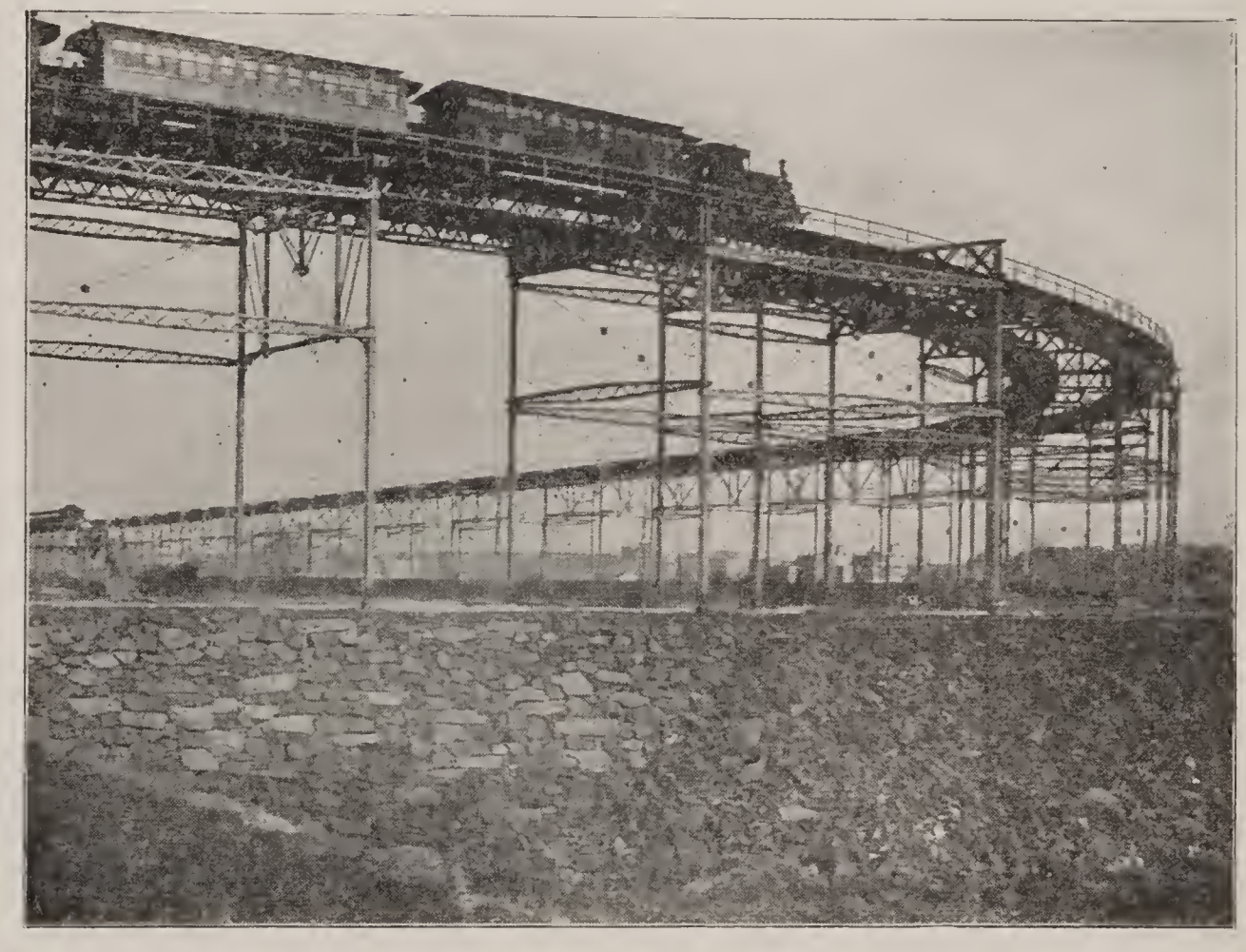
When the distance between New York and San Francisco can be covered in five hours the man living at the end of the nineteenth century will perhaps be content. It takes four days to cover the four thousand miles at the present writing—

Steam's High Record.

A steam locomotive has made a record, over a short distance, of nearly 125 miles an hour, but such a speed, even if it could be maintained for a great length of time, would be dangerous on a surface road. That is why

the elevated structure for trains which are to travel at tremendous rates of speed must be put on, where the danger arising through striking objects and running off the track can be done away with. It is asserted by inventor Beecher that it is an impossibility for his cars to run off the track, no matter what the speed attained.

In 1888, E. Moody Boynton, a resident of Massachusetts, built an elevated road at Coney Island to exhibit the merits of the "bicycle" in railroading. As this experiment had not the advantage of electricity as a motive power, because at that time electricity was not used so extensively, no astonishing speed was shown. But the exhibit attracted a vast amount of attention. Through the contrivance of an overhead guard rail the inventor claimed that it was impossible for the cars to leave the track.



THE GREAT CURVE OF THE NEW YORK ELEVATED RAILROAD.

At its highest point, 116th Street and 8th Avenue. A steel structure upholds the track.

Improving the Plans.

So impressed were other engineers that many began to work on the ideas given by Boynton. George S. Brott, of Washington, D. C., and Captain Lina Beecher, of New York city were the most successful. A sort of steel trench, with guide rails half way up the side, was the first method adopted by Brott to prevent his cars from being derailed. This, however, did not prove satisfactory, and about 1891 the arrangement was changed so that the guide wheels were placed near the base of the cars, though being still on the side and operating on lateral tracks. This is still retained by the Brott system. While the three inventors were all working in the same groove, so to speak, the "monorail" system of Beecher's has withstood the severest test, and for that reason is to-day — in 1900 — considered the most feasible for utilization.

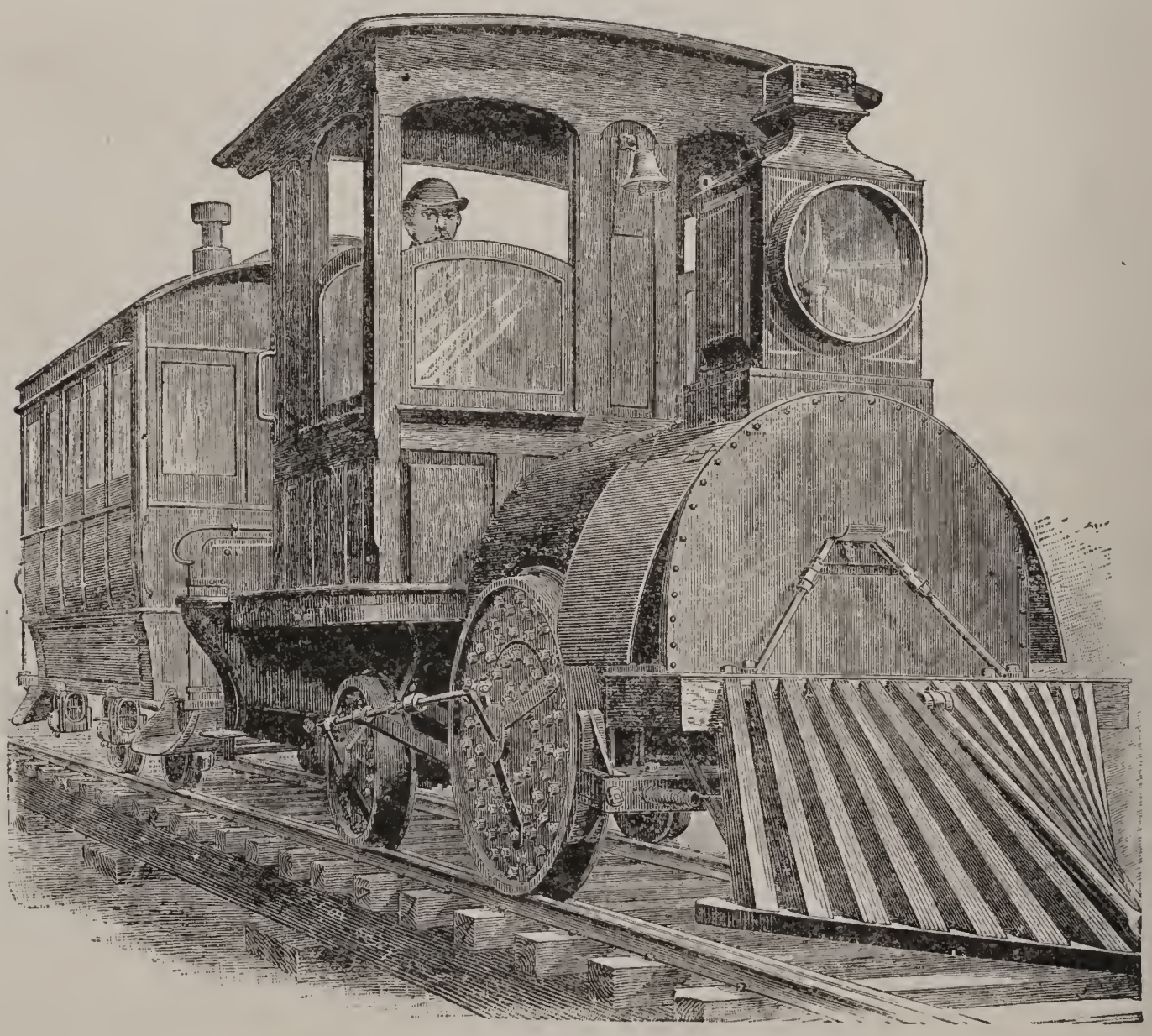
With the main idea one of making it impossible for the cars to leave the track, Beecher worked out his problem. The question of air resistance has been met and successfully overcome as well as the use of electricity as a motive power. Instead of using a car as wide as that of the model of Brott's, Beecher reduced the width to four feet. The cars, or coaches, as they are called by railway men, are built of aluminum and lined throughout with asbestos, which makes everything about the coaches absolutely fireproof.

It is claimed that the cars can be stopped, when running at full speed, within a distance of four hundred feet. Electricity is used as a means of providing heat, and though the coaches are narrow, no lack of comfort is apparent.

Train of One Coach.

Instead of there being a train consisting of several coaches, the Beecher train has but one coach. It has a carrying capacity of fifty and is pointed at the front end so that it looks much like a long bullet. The car contains twelve sections of four seats each, and has also an observation section, of two seats, at the rear end. Entrance to these sections is from the side and every passenger is furnished with a window from which to look out at the scenery.

With motor and all equipment the Beecher car weighs about ten tons, which is about two hundred and fifty pounds to the passenger. One of the finest equipped and fastest express trains in the world, the Empire State, engine and four coaches, weighs four hundred and forty tons, or about two tons to the passenger. It is needless to say that the saving in motive power is vastly in favor of the Beecher system. Beecher claims that the air pressure is greatly reduced through operating but one car at a time. The claim has been made, and subsequent events have proved, that it is impossible to derail the Beecher cars, even when they are turned upside down.



THE MAGNETIC ENGINE

THE "BUCKET SHOP."

How Commodities are Sold Without Any Article of Value Being Put Up—Gambling Without An Actual Purchase—The Victim Has no Recourse and Must Suffer—Cutting the Wool from Lambs.

"BUCKET shopping" differs from legitimate board of trade trading. The legitimate broker makes his profits through the commission paid by his customers, but the operator of a bucket shop can make money only when his patrons or victims lose. Although it is commonly accepted as a fact that trading on a board of trade is nothing short of gambling, respectable people engage in it and are frequently prominent members of the communities in which they reside. People who do business with a "bucket shop" are plain gamblers in the best sense.

It is true that many of the people who are seen in "bucket shops" are men and women much above the average gambler, but they all know that they are speculating on the rise or fall of the price of a given commodity and that the money they deposit as a margin is not used as are margins in the hands of stock and grain brokers. A broker receiving money from his customer actually buys an option on a certain amount of stock, cotton or grain. While for the most part a broker is never expected to buy outright or for "delivery" the entire amount of any commodity or stock upon which he may have an option for his customer he can do so if his customer desires.



THE FRONT VIEW OF THE BOURSE OR MONEY MARKET OF BRUSSELS, BELGIUM, ONE OF THE MONEY CENTERS OF EUROPE.

No Actual Purchases.

With the "bucket shopper" it is just the reverse. He has no intention of purchasing an option in anything, nor does his patron expect it. There is never any actual purchase. The "shop" does not

buy the goods or stock and could not deliver them if the customer demanded it. The Wall Street axiom that the public is always wrong in guessing is the foundation for the existence of all bucket shops. When the gambling public does guess right, as is sometimes the case, the "bucket shop" is apt to close its doors, and those who have actually won on the change in prices are deprived of winnings that in most gambling dens would be promptly paid.

There is no meaner form of gambling than the "bucket shop." The men who engage in it are usually unscrupulous to a degree, and will hesitate at nothing to gain a few dollars to swell their ill-gotten gains. Because the outward form of the bucket shop has an appearance of certain respectability, the influence is worse than other kinds of gambling, which can be suppressed when the limit of tolerance is passed.

Average of Bets.

Bets ranging from one to ten dollars are the average in most "bucket shops." It is no uncommon sight to see messenger boys and young men who receive but a limited salary, wagering their little sums on the fortunes of a turn in the market. Usually there is no chance to cash their winnings, but when a lucky stroke goes their way it is the exception if the operators pay what is due their clients.

Cases are not rare where "bucket shops," in the face of a rising market—that is a market where the prices of most of the commodities are advancing—have urged their customers to buy, with the firm intention of "suspending" when demands for settlement are made. Again there are establishments which do a tremendous business, if it can be so called, and have a capital sufficient to tide them over any temporary embarrassments. Operators of "bucket shops" devise every means possible to get the money of those who become victims. Some concerns of this character make $500,000 a year.

The bogus broker and banker is another evil whose power for doing harm is great. Under the guise of conducting a legitimate business every effort is made to bring under the spell people who are innocent of the "sharper's" ways. Although the New York Stock Exchange and the Chicago Board of Trade have spent thousands of dollars in trying to break up the business of these concerns, they have met with little success.

Swindling Ways.

Solicitors and newspaper advertisements are used to coax the unknowing. Why people who are rational will believe that the "inside information" said to be possessed by the "brokers" can be bought for a mere song when the promised profits are taken into consideration is a source of constant wonderment to those who are called on to help the unfortunates out of the dilemmas that they continually get into through their foolish actions.

One of the most harmful outgrowths of the "bucket shop" is the "Discretionary" pool fraud. This is the baldest swindle ever perpetrated on the public. The alleged operator makes the acquaintance of a victim and is given money to be placed in stocks or grain or some other commodity that "promises best." Of course he reports to the victim that he invested in something that has gone the wrong way of the market and there is nothing left for the investor to do but smile feebly. The peculiar part of it is that the man who has lost the money seems to believe that the operator did the best he could.

RULES FOR A YOUNG MAN'S SUCCESS.

Good Character Necessary—Mental Training Essential—Effects of Dissipation—Caution Against Overwork—Physical Exercise Recommended.

IT has been said that success is mental, moral and spiritual. Most writers who have discussed this vital topic have raised it above a mere sordid interpretation, above the material into the realm of spirit and intellect. One writer says that every truly successful life must necessarily be self-sustaining, and in fact ought to have something more than only the means of livelihood; while, on the other hand, another maintains that success may exist amid the environments of indigence.

If we accept the first definition with the financial clause, we shall certainly come nearer the opinion of the majority of people, since we are living in an age when money-getting is rampant, and therefore it would be inappropriate to omit the consideration of finances. This same authority places character above all other requisites. He says:

"Bodily vigor is good, and vigor of intellect is even better, but far above both is character. It is true, of course, that a genius may in certain lines do more than a brave and manly fellow who is not a genius; and so in sports vast physical strength may overcome weakness, even if the puny body have in it the heart of a lion. But in the long run, in the great battle of life, no brilliancy of intellect, no perfection of bodily development will count where weighed in the balance against that assemblage of virtues, active and passive, which we group together under the name of character."

Kinds of Character.

Perhaps this observation would have been truer if the author had said "good character," for character may be either good or evil, since it is only another name for the personality of men—and men are both good and evil. Shylock had plenty of character. It obtruded, so positive was it; but it was the wrong sort. It was evil. Considering the matter of material success, opportunity and possibility deeply absorb the attention of the ambitious young man, and for him one writer has these encouraging words:

"The average young man into whom the average boy develops is, of course, not going to be a marvel in any line, but if he only chooses to try he can be very good in any line, and the chances of his doing good work are immensely increased if he has trained his mind."

In this age there is no excuse for ignorance. We are so abundantly supplied with means of education—within the reach of all—that it is the question nowadays, "What shall I not study?" not, "What shall I study?" Your successful elder will tell you to be patient and industrious, and to work hard, but that unaccompanied by intelligence—the trained

mind—will not bring success; although all those are very necessary.

A mule is patient, industrious and hard-working, and he has been properly named an "ass." Given the opportunity, then, to be "very good in any line," the first and continual step of the young man—for



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HON. D. B. HENDERSON.
Speaker of the House of Representatives.

successful men are always learning—should be the training of his intellect. If a college or university education be beyond his reach, he may follow in the footsteps of Lincoln, who learned more by himself than any school could have taught him. The chief value of our schools is that they establish mental discipline and studious habits, rather than that they deal directly with the practical affairs of life; although their present tendency is in that direction, as our manual training, domestic science and business schools attest

The next logical step is the choice of a profession, and there many mistakes are made, for the young man usually examines the field with regard to its value alone, and not with regard to its value to him. "Is it a good business?" is the question, not, "Is it a good business for me?" No man can succeed in a work which is distasteful to him.

Qualities Necessary.

Having intelligence and the choice of a profession assured, it is thoroughly agreed among successful men that reliability is the next consideration, and next in importance is resolution and perseverance.

"Perhaps there is no more important component of character than steadfast resolution," writes one.

And another:

"The unreliable man is a public nuisance."

And again:

"One must be systematic, assiduous and painstaking in the prosecution of his enterprises, and must cultivate the good opinion of his fellows."

And:

"Chief among the causes which bring positive failures is vacillation."

A noted pugilist once put a philosophy into these words:

"Any man who can't take a punch had better not get inside the ropes."

It is the ability to take the "punches" of experience and get on his feet a little wiser, that grim determination to surmount insuperable difficulties which characterized Grant when he said: "I'll fight it out on this line if it takes all summer," the "staying power": these are the emblems of that irresistible force we call determination.

Most young men have an idea that it is permissible to "sow wild oats." Such a fallacy should be instantly dismissed. Dissipation has three serious effects in a young man's life. Naturally the most important of these is the attitude of the prospective employer toward it. An applicant who shows signs of indulging in liquor or other vices has no chance against him who is morally clean. The cigarette has been black-mailed by many large firms.



THE BEST EXAMPLE OF INDUSTRY.

An apiary or bee farm in California where honey is produced by scientific cultivation of bees.

Further, the effect of dissipation upon the physical and mental power is disastrous. Who has not read in the lack-luster eye of the dissolute the feeble mind and inert body. The third is what has been called the "spiritual" effect, and there can be no doubt that the spiritual nature is deadened by neglect.

Evils of Overwork.

A serious error among the youth of to-day may exist in overwork. A successful financier once wrote: "Overwork is worse than no work," and he was right. The ambitious young man should take the measure of his capacity for work carefully, and never overtax it. Another sees a national danger line. He says:

"For the only danger before capable young Americans, and, indeed, before our nation, is that of hurrying too much, of sweeping on too rapidly, of straining every nerve too tensely, of living our lives too strenuously. What most young men of this country need is restraint, not stimulant. What this nation needs is reserve. The only serious fear I entertain is that the rapidity of our lives will make us neurotic and decadent."

Here should be emphasized the value of physical exercise. Young men do not seem to realize that brain power relies upon physical strength. It is the foundation of all activity. True, some great men like Byron were weak physically, but

bright minds over weak bodies usually result in early death, as was the case with Byron.

George Washington was the best wrestler in northern Virginia, and Lincoln, in spite of his spare build, was a powerful man. It is the physical reserve that carries great men through crises. So every young man should be as careful in training his body as he is in his mental and moral attributes. To sum up, then, any set of rules for the guidance of young men aiming for success ought to include:

Mental training,
Honesty,
Reliability,
Perseverance,
Morality,
Caution against overwork,
Physical culture.

This will, if properly followed, insure a symmetrical development mentally, morally and physically. And in addition to this the spiritual life must not be neglected. Church work of any sort is a source of power, and is very pleasurable. In conclusion, these words of a prominent public man will be appropriate:

"There is just one lesson these ancient ruins (of Nippur) teach, and that is the nothingness of fame, and that the only real things in life are love and duty. I cannot think of any blessing so great to an ardent young American as to learn on the very threshold of his career of activities that duty and affection are the only things really worth his while—the only things that pay increasing dividends and never become bankrupt."

The Most Expensive City in the World.

New York's Annual Expenses Compared with those of Other Cities—Sources of Revenue—The Sinking Fund, Annual Receipts.

THE annual expenditures of the city of New York are greater than those of any other city in the world. The gross budget of the city for 1899 was $20,000,000 greater than the expenses of London, $18,000,000 in excess of the budget of Paris, and only $1,000,000 less than the combined expenditures of Boston, Chicago and Philadelphia. The expenses of the city for 1899, for local purposes only, amounted to $19.56 per capita of an estimated population of 3,500,000.

On January 1, 1900, the gross accepted debt of New York City was $358,104,307.11, against which there was a sinking fund of $105,435,871.70, leaving a net funded debt of $252,668,435.41. The city of Paris, with smaller available resources than New York City, has a debt in excess of $500,000,000. The gross expenditures of the city during 1899, not including permanent improvements, paid from the proceeds of bonds were $93,520,082.03.

The total receipts of the city for the same period, from all sources and for all purposes, according to Bird S. Coler, the city comptroller, were approximately $108,000,000. The income was derived from three general sources, taxation yielding $84,000,000. The budget, which represents the money to be raised by taxation, was reduced $9,000,000 by income

known as the general fund. The chief items of this were:

Excise taxes	$3,600,000.00
School money from the state	1,280,883.45
Fees of various county and city offices	246,576.65
Interest on taxes and assessments	979,185.35
Unexpended appropriations	1,356,786.57

The gradual reduction of the city debt, except as it is maintained or increased by additional bond issues, is provided for by an increasing and protected sinking fund. In 1899 the total receipts of this fund were $15,601,492.50. The Croton water rents, which amounted to $4,590,502.55 in 1899, are applied to this fund, as well as the dock and slip rents of $2,362,421.14



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HON. SETH LOW
Mayor of Greater New York

Among the other chief items of this fund are:

Revenue from investments	$3,573,519.34
Ferry rents	370,776.00
Market rents	251,500.00
Interest on deposits	520,526.00
Installments included in the budget	2,633,110.00

More than $1,000,000 is derived annually from miscellaneous sources.

The budget of the city for 1900 is $90,778,972.48. It will be interesting to compare these figures with the expenditures of other cities. The approximate current expenses of London in 1899 were $73,000,000; of Paris, $75,000,000; of Berlin, $23,347,600; of Boston, $35,454,588; of Chicago, $32,034,008; of Philadelphia, $27,075,014. This comparison shows that New York City is the most expensive city in the world.

NAVY YARDS OF AMERICA.

Birthplace of America's Great Battleships—Their Manner of Construction—Origin of the Kearsarge—Where the Oregon Came from—The Illinois Now Under Way.

IN the Long Island side of the East River, between the Brooklyn bridge and the Williamsburg ferries, is located the famous Brooklyn Navy Yard, the home of the North Atlantic fleet. The place first became famous during the revolutionary days when the British prison ship Jersey was anchored in the harbor with its thousands of American prisoners.

The first sight presented to a visitor in the yards is a park of guns. Here are Mexican mortars, Confederate howitzers and other trophies that mark the prowess of sailors. The offices and storehouse, like a little town in themselves, present the next busy scene. Then comes a host of boiler shops, machine shops, blacksmith shops, foundries and many other buildings in which the myriad parts of the floating forts are manufactured. Occasionally Uncle Sam builds his warships entirely, as in the case of the ill-fated Maine and the Texas.

These yards excel in dry docks, repair shops, coaling stations and in facilities for overhauling vessels. Every conceivable ship from a monster of 10,000 tons to the minute torpedo boat, although the latter type is not a feature in the construction of the new navy, may be seen there.

On the Pacific coast the great navy yard is at Mare Island, where the coast defense vessel, the Monterey, was outfitted. Mare Island is a short distance from the city of San Francisco, and is finely equipped for the needs of our navy. Another ship-



A GIANT WALKING CRANE HAULING GUN BARRELS.
At the Washington Navy Yard. This Crane travels on an elevated track.

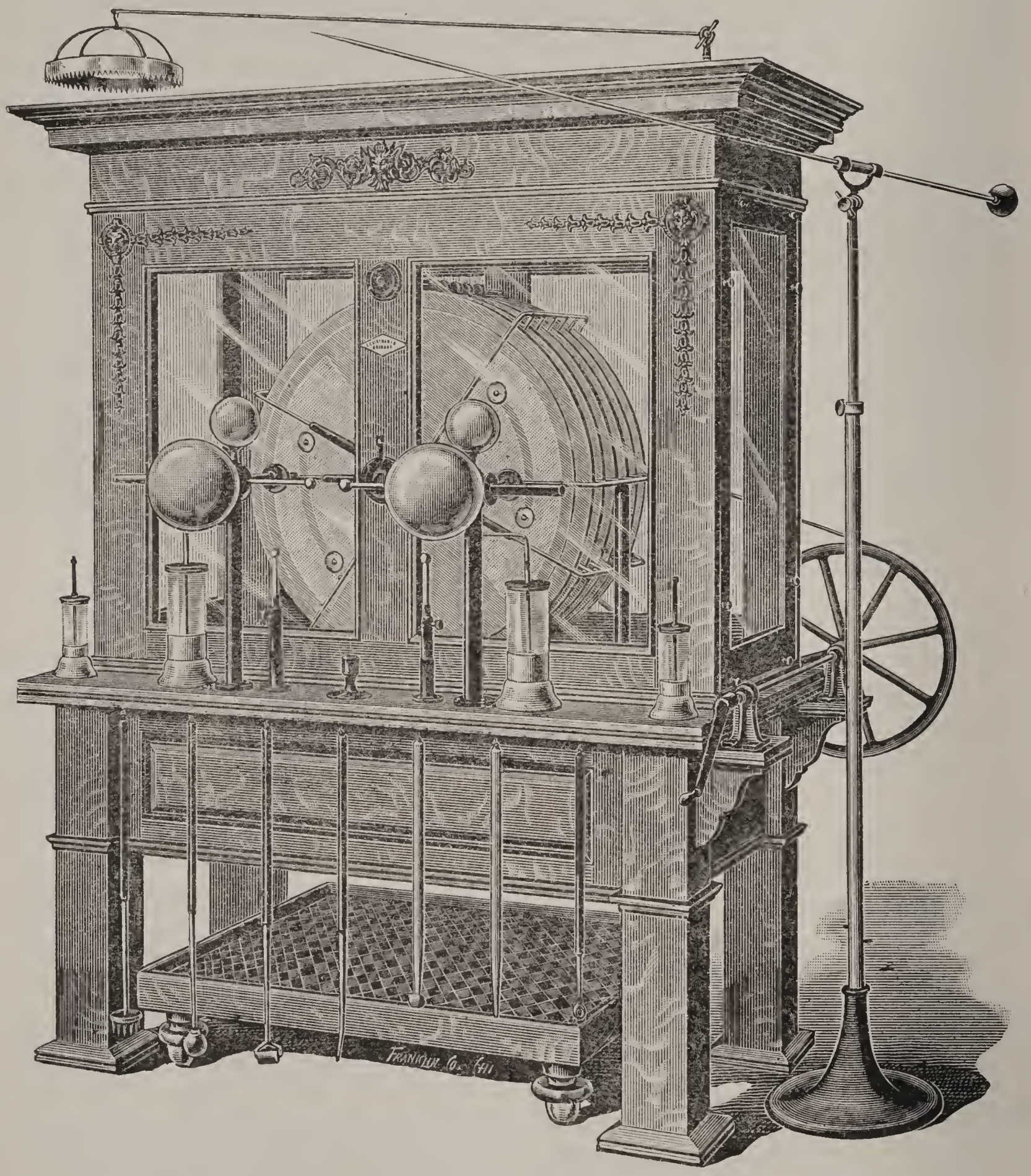
building yards is at Newport News, Virginia. The Kearsarge, the Kentucky and the Illinois were built here. Uncle Sam is not as well equipped with large naval establishments as he needs to be, but there is an indication that Congress intends to remedy this defect at an early date.

STATIC ELECTRIC MACHINE.

Transmitting Electricity to the Human Body—Form of Electricity—Its Effects—A Harmless Stimulant.

THIS is a static electricity machine invented and constructed for the purpose of transferring frictional electricity to the human body without harm. In the illustration the machine is shown as operated by a hand wheel, but they are also run by small electric batteries. When the machine is in full operation frictional electricity is developed and passed to the human body in the form of vibrations instead of a direct shock. The mode of transmission is either through the cap in the illustration, which looks like the spray of a bath tub, and which is suspended over the head, or by means of handles which the patient grasps. The effect of the static electricity passing through the

body is to stimulate the circulation, restore the nervous energy and increase the amount of reserve strength. It is a healthful and pleasant treatment for persons with weak nerves and torpid livers. So far as its effect on the system is concerned, it is harmless.



A STATIC ELECTRIC MACHINE.

The purpose of this machine is the transmission of vibratory, frictional electricity to the human body, without a direct shock. Transmission is made by means of the crown suspended over the head, the pointed rod, or by handles.

CRIMINAL AND CIVIL LAW.

What Criminal Law Provides—Dueling a Crime—Division of Law—When Martial Law is in Effect.

IGNORANCE of the law is no excuse.

You cannot lawfully condone an offense by receiving back stolen property.

The police are not authorized to make arrests without warrants unless they personally know of the offense for which they may be made.

The adage that "Every man's house is his castle" does not apply when the man is accused of crime and a warrant is sworn out against him.

Embezzlement can be charged only against an officer, agent, clerk or servant of a corporation.

Petit larceny is when the property involved is less than $25; grand larceny when over that amount.

The crime of arson must have been committed at night and when the buildings were inhabited.

Drunkenness is not a legal excuse for crime, but when it has gone to the extent of delirium tremens it is often held as insanity.

A female is not exempt from arrest except in civil cases; criminal matters make her liable.

When a sheriff appeals for assistance every man is in law bound to obey the call.

Criminal Carelessness.

Criminal carelessness is a crime, but accident is not. If, through carelessness an elevator falls and kills passengers, the owner and operator may be liable criminally. But if a man is shooting at a burglar and accidentally kills a member of his own family it is not a crime.

Murder to be in the first degree is—must be premeditated, malicious, willful and committed while the murderer is engaged in a felonous act. Dueling is a misdemeanor, as is a challenge to such combat; and killing in duel is murder.

False swearing to be perjury must be willfully done. If a man says that "he believes such to be the case," or that "to the best of his ability such is the case," it is not perjury if the facts are falsely stated. A false statement must be absolute. Subornation of perjury is a felony.

A felony is a high crime; the highest of the principal classes into which crimes are divided by statute; a grave crime exceeding the grade of a misdemeanor.

Forgery is a copying or signing the name of another to any document, with intent to deceive or defraud.

An "offer or attempt at assault" is all that need be proved to show a case of assault. Battery presumes bodily violence.

Bigamy cannot be proved at law when one of the parties to the marriage has been absent and not heard from for five years.

Civil Law.

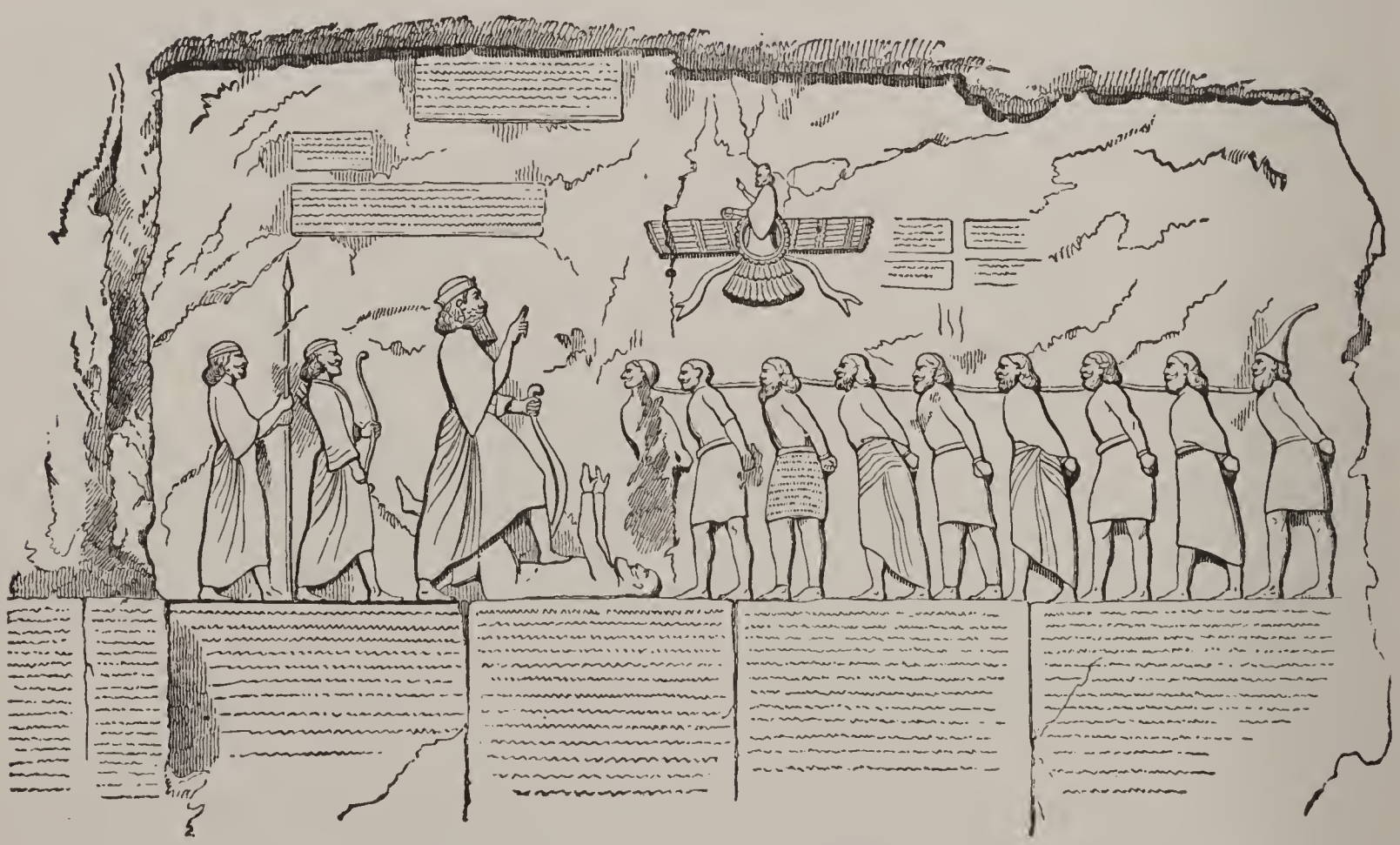
Civil law is a rule of action established by the recognized authority of the state or government to enforce justice and direct duty. All law is divided into the following:

LAW.

Between God and Man		Between Man and Man	
Natural	Revealed	*National* or *Municipal*	
		Constitutional Law	
		Cannon or Ecclesiastical	
		Equity and	*Common Law*
			Public or Criminal
			Private or Civil
		International.	

Civil law is that system of jurisprudence which the people of any State or nation establish for their government as citizens. It particularly relates to all not connected with the criminal. It covers indebtedness, actions on notes and mortgages, actions in trespass, to quiet title to property, to adjust titles, to collect money, to recover damages, to secure divorce and kindred suits.

Commercial law is a branch of the civil law relating to legal proceedings in connection with commercial houses. Maritime law relates to questions pertaining to affairs of the sea. Martial law is in effect when the civil authorities are superseded by the military authorities. Military law is that relating to the army. Municipal laws relate to those of the city. The Roman law is that formerly administered by the government of Rome. The laws of Napoleon are those laid down by the first Napoleon of France. Sumptuary laws are those regulating the traffic in intoxicating liquors.



ANCIENT JEWISH CAPTIVES

TRUSTS AND COMBINATIONS.

Origin of Trusts—Necessity for Combination of Capital—Difference Between Monopoly and Trust—Some Court Rulings.

THE progress of civilization has led to combinations of capital and the centralization of control. The signs of this are no better shown than in the desire of people to seek places of dwelling in large cities. While the tendency of private business houses for many years has been toward combination, not until 1898 did people begin to look at the so-called trust, or combination, as a thing to be shattered and blown to the four winds.

The first element which is the inducement for forming combinations is the limitation of the liability of the parties involved. The second is the perpetuity of the business and the fact that, unlike a partnership, the company does not dissolve upon the death or removal of one or more of its members. Many business houses have been converted into private companies which possess the advantages already mentioned but which do not properly belong to combinations.

A general depression of business and a falling off in the profits of the ordinary business, forced men to look around for means by which expenses could be curtailed. When every method of reducing expenses had been exhausted, it became compulsory to seek additional ways to make both ends meet. After some little experimenting it was discovered that several competing firms, by uniting in the distribution of products and arrangement of price and the adjustment of credit, could raise the profits.

These arrangements were first called "pools." As they were merely verbal agreements, they were often violated in secret for no other reason than because no binding contracts had been drawn among the firms in the understanding. The outcome of this led to the formation of many concerns under one central control, and these were nothing less than combinations.

Origin of Monopolies.

A monopoly, so called and often confused with the terms "trust" and "combination," was originally a grant or license by the crown to a subject for the exclusive privilege of buying or selling, making, working or using anything. In the course of time the term monopoly has come to be used in relation to any natural or economic condition wherein a particular trade, industry or occupation is under the control of a few persons Properly speaking, the term has no place in current discussion of trusts and combinations. It is used because three centuries ago it became so obnoxious to the English-speaking people that it serves to arouse prejudice to call anything objectionable a monopoly.

A trust, as interpreted in the year of 1900 is a combination of corporations formed by the creation of a trust, wherein

stockholders of the several corporations deposit their stock with trustees, receiving in return receipts in the form of trust certificates; the control of the several corporations being vested in the trustees, who thereby formed one central body.

In 1899 when the courts decided, in the North River Sugar Refinery case, that it was illegal for corporations to turn over to a body of trustees the control of their affairs this form of combination has virtually been abandoned. It will be seen, therefore, that as the term "monopoly" is irrelevant when commonly used to express the meaning of a combination, so also is the term "trust." Nevertheless both these terms are used and present indications are that they will be used for some time to come. When any one of the three expressions is used, therefore, in most cases it will be discovered that the combination form is referred to.

Watering Stock.

There are combinations doing good to the community, and there are others which can be called nothing short of "pirates." In the latter case the prime evil is that of watered stock. This came about at first through the necessity of rewarding the promoter, or the man who was responsible for bringing about the formation of the combination. Watered stock is simply the issuing of engraved paper which represents no assets. It has no reserve to back it up, pays practically no dividend, and for this reason is worthless except to be used by speculators for such purposes.

Many combinations have been formed for no other purpose than to be put upon the Wall Street market and made the basis for speculation. So frequently has this class of stocks made its appearance that they have finally come to be called "gambling industrials," and no financier with any shrewdness could be prevailed upon to waste his money in purchasing them.

The combination based on integrity that can be relied on to do what is fair is a blessing. Combination, which rightly interpreted is co-operation, must be the foundation of every honestly conducted trust. Industrial combinations must be conducted on an industrial basis which means several things. First, a fair reward to the wage earner; second, the



COMMODORE VANDERBILT, Wealth, $100,000,000, Father. | WM. H. VANDERBILT, Wealth, $200,000,000, Son. | CORNELIUS VANDERBILT, Wealth, $100,000,000, Grandson. | ALFRED VANDERBILT, Wealth, $150,000,000, Gt. Grandson

THE VANDERBILT MEN.

The four generations since the founding of the family.

production of the best article at the lowest price; third, honest dividends to honorable stockholders, and, fourth, an honest board of directors.

Legality of Combinations.

The test of the legality of a combination is its object. Every combination organized to do anything contrary to law is illegal, regardless of its size or the form of its construction. On the other hand if the object of the combination be within the confines of the law neither size or form will render it illegal.

If a combination is formed for the purpose of controlling prices, production or competition, then it is illegal. The object of all laws and decisions against combinations to control production, prices or competition is to protect the community against the maintenance of prices at levels higher than they would be if competition were unrestricted and production and prices uncontrolled. The main interest of the public is in the price it has to pay for any article, and the popular outcry against monopolies, trusts and combinations is based entirely upon the assumption that they all compel the public to pay higher prices for whatever is controlled. In many States there are laws against combinations of any sort, and for this reason one or two States, such for instance as New Jersey, are made the main places where combinations are organized and incorporated.

There are many combinations of labor, formed for the purpose of advancing the condition of the laboring man. These are all considered legal though some of them really act as restrictions on employers. It is said that some labor leaders who are far-sighted have discovered that it is mainly with large combinations of capital that equally large combinations of labor can deal with certainty of permanent result. In 1890 Congress passed a federal anti-trust act making it a criminal offense for two or more persons to agree to combine in any manner to restrain or monopolize, in part or in whole, interstate commerce.

Each State has the power to prescribe terms and conditions upon which corporations can be created under its own laws, and, what is vastly more important, each State has the power to prescribe the terms and conditions upon which it will permit the corporations of other States to do business within its borders. If the State sees fit the corporation may be excluded from its territory. They may be crudely organized and may frequently abuse their powers, but beyond the prevention of the abuses legislative interference with combinations appears to be diminishing each year. The province of the law is to restrict evil and to conserve the good.

POLITICAL ORGANIZATIONS.

Birth of Tammany Hall—Its Large Field of Labor—A Powerful Organization—Other Organizations and Their Leaders.

NO United States President, or governor or mayor of any city, is elected to office without the aid of a party organization. The head of the organization may not hold an office paying a salary. He may never have held office requiring the payment of a salary from public funds, but this does not affect his power.

Republicans and Democrats alike, in the United States, have organizations perfected to the last detail. It may be a national or only a ward organization, but whatever it chances to be it is so arranged that it works without friction, and can, for the most part, be relied on to deliver to the polls a certain number of votes.

Often one man holds the reins over a political organization. When this state of affairs exists it is called a one-man power. It is almost incalculable the amount of influence wielded by certain politicians who live solely to run an organization of this sort.

In America the most perfect organization in politics is Tammany Hall. Some people say that nowhere is there so remarkable an organization of the kind. This organization, which controls absolutely one hundred and ten of the one hundred and eighty thousand Democratic voters of the city of New York, is under the thumb of Richard Croker. What he says is final.

Croker, All-Powerful.

No man or number of men in the organization have ever been able to successfully stand against the will of the most powerful leader Tammany Hall has known. So wonderful is the mechanism of this "tribe," as it is sometimes called, that were it necessary every one of the voters under its control could be reached, without the assistance of a newspaper or any sort of advertisement, within a few hours.

There might be a strong wave of popular sentiment against one or more of the candidates offered by Tammany Hall. There might be a principle involved that would cause the bitter antagonism of the majority of the so-called respectable citizens, but this would produce little effect upon the leader of the "braves" or his followers.

The only post ever held by Richard Croker was that of chairman of the committee on finances. This position he appointed himself to fill, and from its authority he has directed the forces that for years have resulted in the securing of a monopoly on the administration of New York City's affairs.

In 1900 the tower of Richard Croker, after having once announced his withdrawal from the leadership, was greater than ever before. John F. Carroll is deputy leader of Tammany Hall. When



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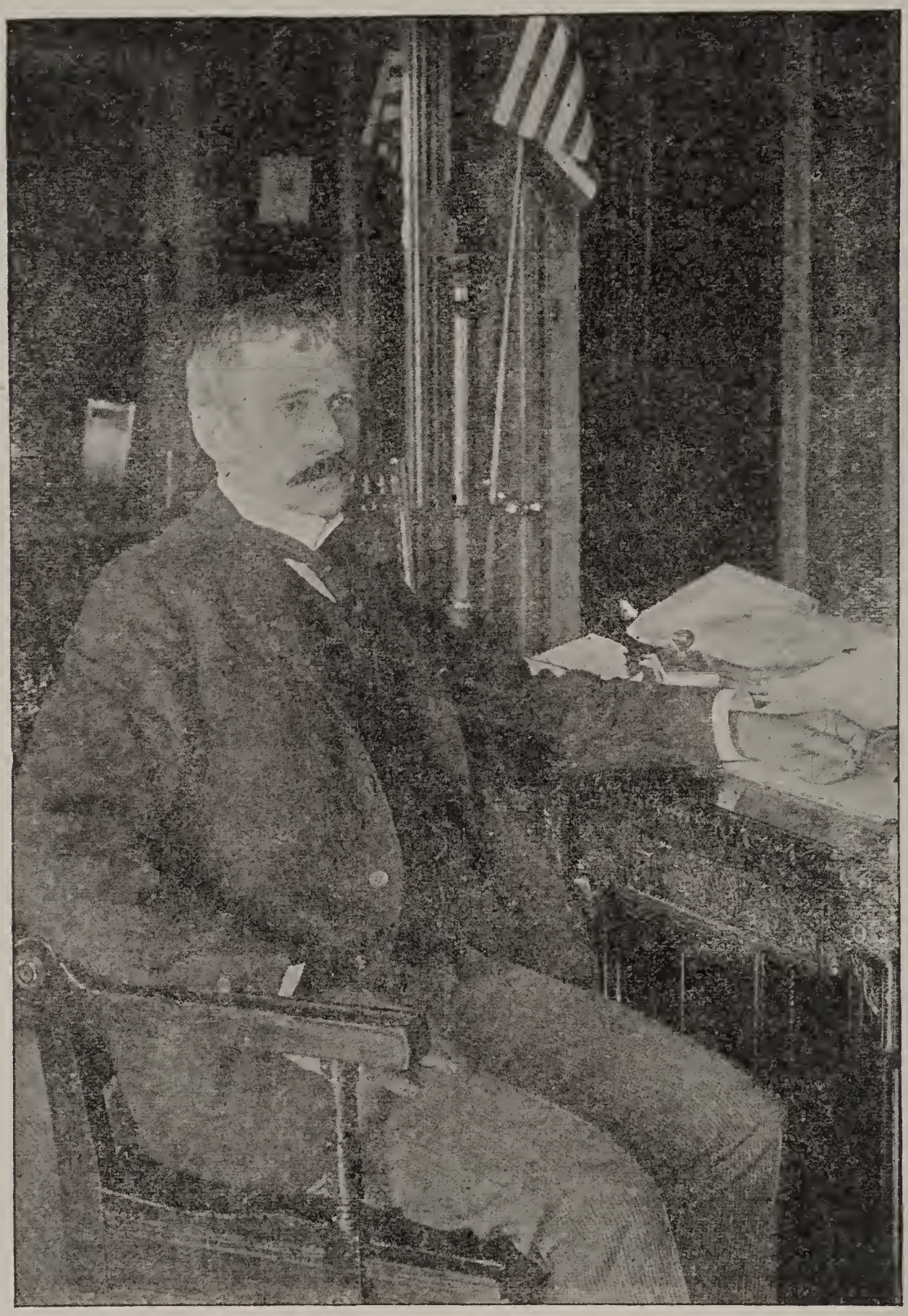
RICHARD CROKER.
Well-known Democratic leader.

the "Boss," as Croker is called, is away Carroll wields the scepter of authority, and no one thinks of opposing his dictations.

Character of Tammany.

The Tammany organization, or the Democratic-Republican organization of the city and county of New York, as it is known officially, is composed of the Tammany general committee, in turn made up of some four thousand members elected from the various districts.

As New York county is divided into thirty-five Assembly districts corresponding to the wards in other cities, there are this number of leaders known as district



ELIHU ROOT.
Secretary of War.

leaders. These men are at the beck and call of the head of the organization.

Each assembly district has a representative of from two to eight hundred members in the general committee, and these members are regularly elected in the primaries. A member of the general committee in each district is elected to a place on the executive committee. The executive committee supposedly runs the machine, but in reality all that it does in the way of official duties is to approve the selections or appointments made by the "Boss," whoever he may be.

The name "Tiger" is sometimes given this powerful organization. It comes from the Tammany Society, and in connection with it there is a tradition that



STEPHEN B. ELKINS.

Chief Tammany once made a speech during which he addressed fifteen Indian tribes, and that the chief gave to each the name of an animal to be taken as a symbol of the tribe. Originally the eagle, the symbol of the first tribe, then in New York State, was taken, but before 1870 the eagle had been replaced by the tiger, the former symbol of Delaware.

Tammany Hall, while doing most of its work among and through the influence of the Democrats, really does not represent a political party, for it is conducted on principles nothing more or less than those of any well-systematized business. The men in the Tammany organization are in politics for what they can get out of it, and they are all willing to admit that fact.

Age of Tammany.

Tammany Hall has been in existence since before 1800. While in 1900 there were signs which indicated that it might



SENATOR HENRY CABOT LODGE OF MASSACHUSETTS.

go down to destruction before many years of the twentieth century had passed, the power displayed in the nominations of 1900 by these "braves" of New York was astounding.

One of the secrets of Tammany's success is that the district leaders are never interfered with in matters relating to the district alone. This unwritten law has caused more than one man, who attempted to violate it, to realize that it was made to stand the test of time. Another reason for Tammany's steady march in the direction of financial reward is the pains taken to provide for all in any way related to the organization who stand in need of assistance.

Twenty-nine of the thirty-five district leaders hold public offices paying salaries ranging from four to eight thousand dol-

lars a year. The other six are merely out of office temporarily, and are amply repaid for any waiting they may have to endure for the benefit of the organization as a whole. There is plenty to do for the Tammany district leader, even though he may not be busy with the duties of public office.

The followers of Tammany must be kept in line and cared for if they require money to tide them over a temporary period of financial distress. This requires the almost incessant working of the district leader and his precinct captains, who are never through with their work. No person on the Tammany "rolls" ever gets out of sight of the organization workers. While the bulk of the work done is among the poorer element, the well-to-do and even some of the wealthy come under the influence of the "Tiger."

The relative of a voter who can control a few votes besides his own can always secure a position through Tammany. The widow who is in need, if her case be worthy, never looks in vain for relief if the precinct captain is within reach. Men who get into trouble resulting in their being arrested are released from confinement on bonds provided by Tammany money. The precinct captain may be called out of bed in the middle of the night to do some favor for one or more of Tammany's dependents, but he does not complain, for here is where his power lays when it is necessary to obtain votes at the proper time.

Losing Power.

The abolition of the "saloon boss" through the introduction in 1895 of the secret ballot and the civil-service reform introduced about that time, have robbed Tammany of much of the power it formerly had. As a result the men in positions paying good salaries, who, as hold-overs, are exempt from taking the examination they surely could not pass, have grown lazy, and many have refused to do the work necessary before and during election times to bring a victory.

Rumors which have been afloat since 1898 to the effect that charges and counter charges have been going back and forth inside the "Wigwam" promise ill for the ultimate career of an organization that will never again be equaled in the history of political events.

All the large cities of the United States have strong Republican and Democratic organizations. The great Republican organization of New York State is controlled by Senator Thomas C. Platt, and is almost as perfect in its working parts as that of Tammany. A great Republican combination is controlled in Chicago by Congressman William Lorimer, while Mayor Carter H. Harrison heads a similar Democratic organization. James G. Blaine, when a candidate for the Presidency, built up what might be termed a "machine," which was almost perfect in its workings. When an effort was made to nominate Gen. U. S. Grant for the Presidency a third time a similar organization worked for him. President Cleveland was never able to perfect such an organization. Nearly all these combinations of politicians are more or less successful as they are able to distribute offices among the men who are their members.

MAKING ARTIFICIAL ICE.

Principle of Machines Used—Method of Freezing and Use of Ammonia—The Ice Crop in the United States.

ICE is now largely manufactured by artificial means. In this day of transporting fresh meats, vegetables and other perishable foods thousands of miles, and when such great industries as that of meat, fruit and others depend largely upon preservation by cold, it was but natural that scientists should cast about for some means of producing refrigeration by artificial process. The expense of cutting ice, together with the uncertainties of the crop because of mild weather, is a source of great dread to merchants; but with a plant equipped for the manufacture of ice little or no trouble is experienced, and the cost is reduced proportionately.

In such industries as great breweries it would be almost impossible to keep the temperature at the required degree without laying in great supplies of ice, and in the great storehouses of the large meat establishments even more inconvenience would be experienced.

Ice-making Machines.

The principal on which ice machines are operated is that of the absorption of heat of the surrounding atmosphere by the circulation of a liquid of exceedingly low temperature—generally ammonia. Sometimes the process by expansion after great contraction is used, as in the process for making liquid air. This method is governed by the principle that when a gas is contracted it becomes warm, but upon being liberated becomes cool again. If, then, air is submitted to a great pressure and while thus confined is cooled by being passed into pipes bathed in cool water, upon being liberated it will seek to absorb so much heat from the surrounding atmosphere that ice will be formed in its neighborhood. Liquid air has produced the greatest artificial cold, but as yet it has not taken the place of the ammonia ice-plant.

The principle governing this latter process is that, inasmuch as anhydrous ammonia boils at 32 degrees below zero, Fahrenheit, water when brought in contact with it at 32 degrees F. will at once give up 64 degrees of its heat to the ammonia, and will thus become so cold that it freezes.

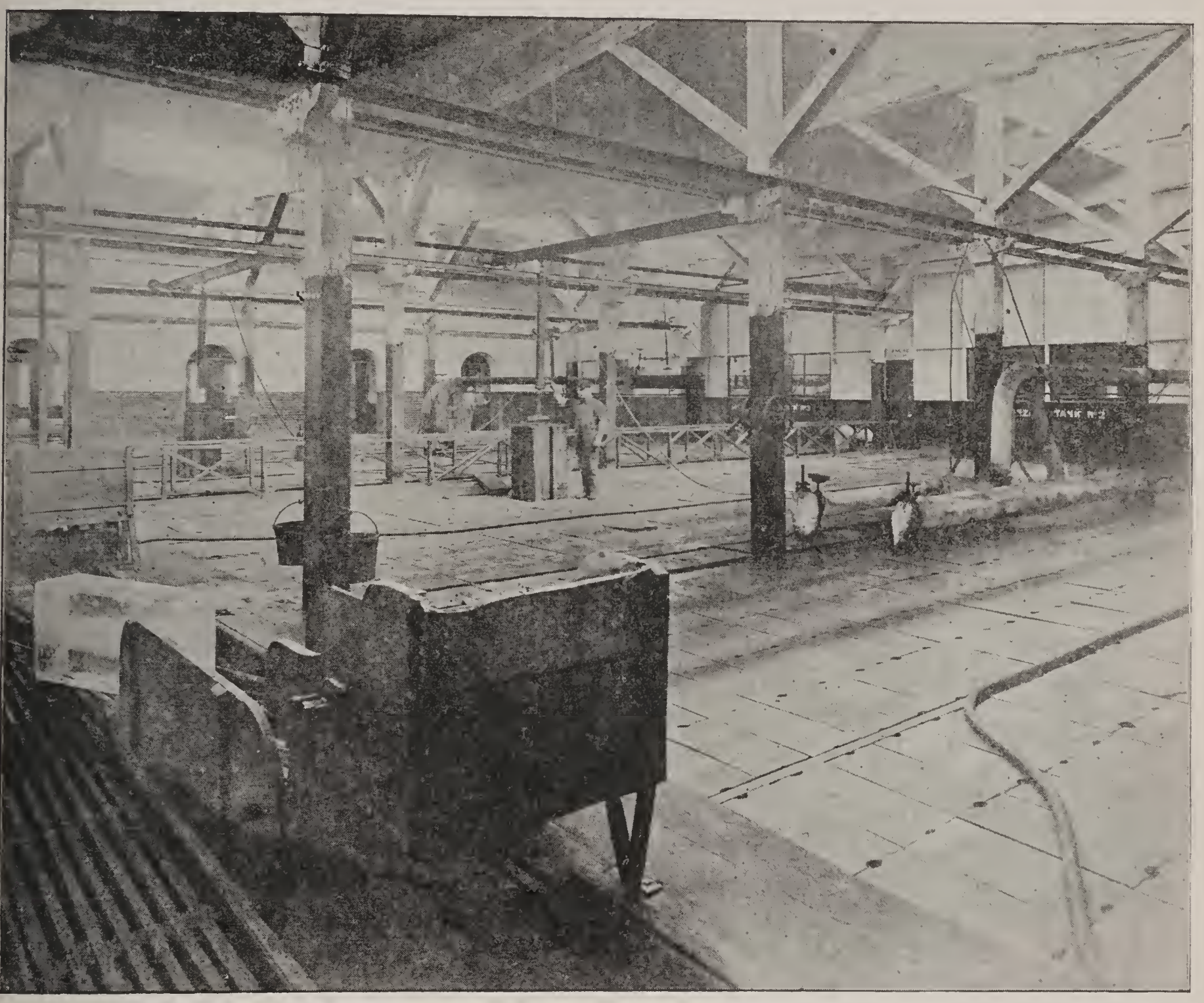
A Freak of Science.

Numerous methods for making use of this freak of science are in operation. One plan, called the "can" system, is to expose water in cans to the ammonia circulating through coils of pipe laid in a tank of salt water. The ammonia absorbs the heat from the salt water, and this in turn freezes the water in the cans by absorbing its heat. This plan is varied sometimes by circulating the ammonia through great pipes in refrigerators and cooling rooms without making the ice, the heat being absorbed at first hand, thus reducing the temperature to a certain

degree of cold. The can process is somewhat antiquated, and while being effective is rather expensive by reason of its bulkiness and the long time it takes to start a plant operating—generally about three days.

same principle of ammonia absorption is used, but everything is more compact, and ice can be produced within a few hours after the plant is started.

The Holden method consists of two parts; the devices for circulating the

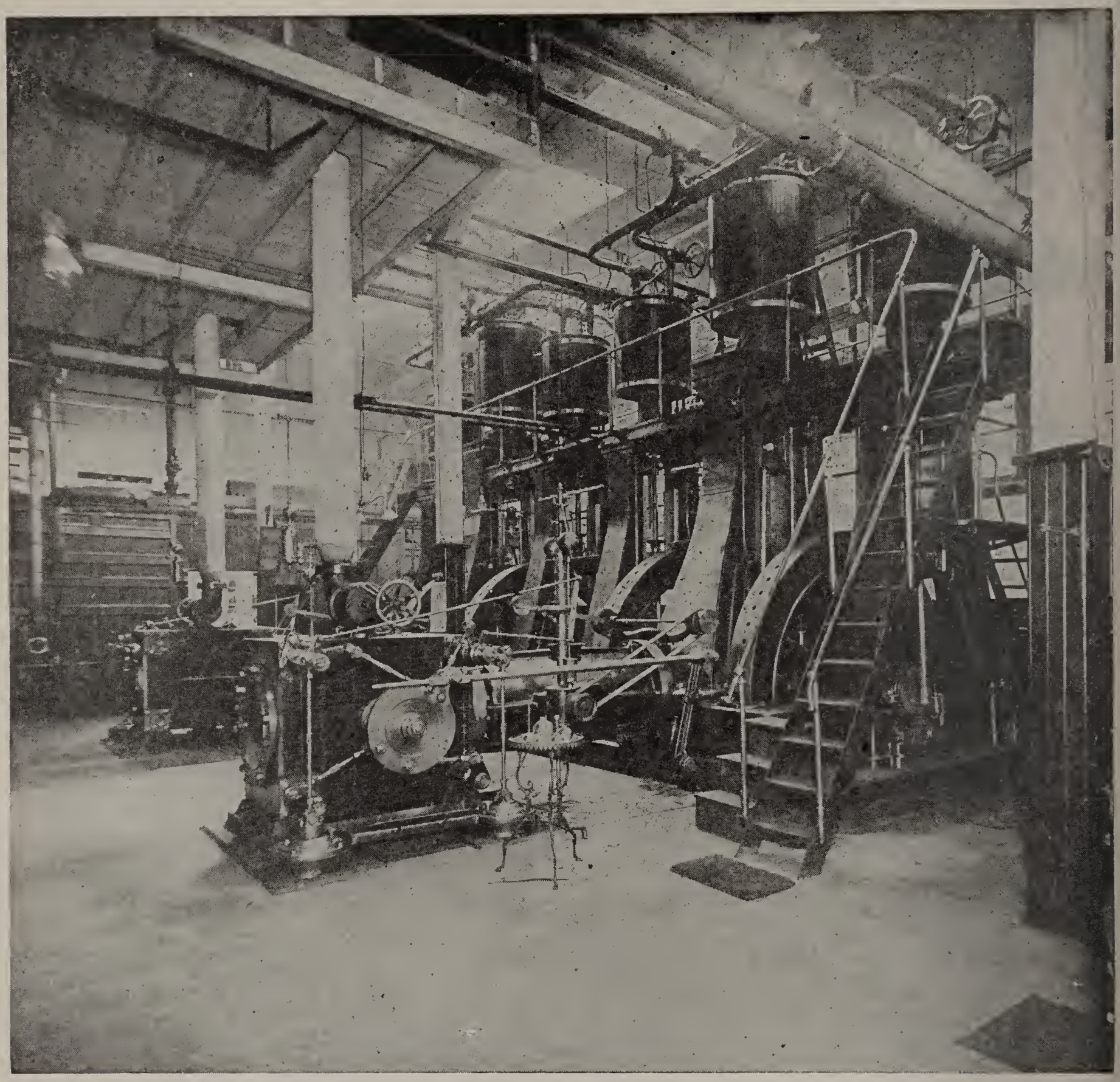


VIEW IN THE FREEZING ROOM.

The freezing water is in square tanks beneath the floor. Each tank is block of ice size.

To overcome these deficiencies, D. L. Holden has put into operation a new system which makes ice at 50 cents a ton with space required for a plant of only 25x50 feet, as compared to 100x150 feet for the can system, and a cost by the latter of from $1.65 to $1.85 a ton. The

ammonia without loss, and the ice machine. The ammonia system is a combination of the compression and absorption systems. For it there are necessary three vertical pipes, twelve inches in diameter and forty feet high. They are the still, the absorber and the condenser; and



ENGINE ROOM OF THE CONSUMERS COMPANY ICE PLANT.

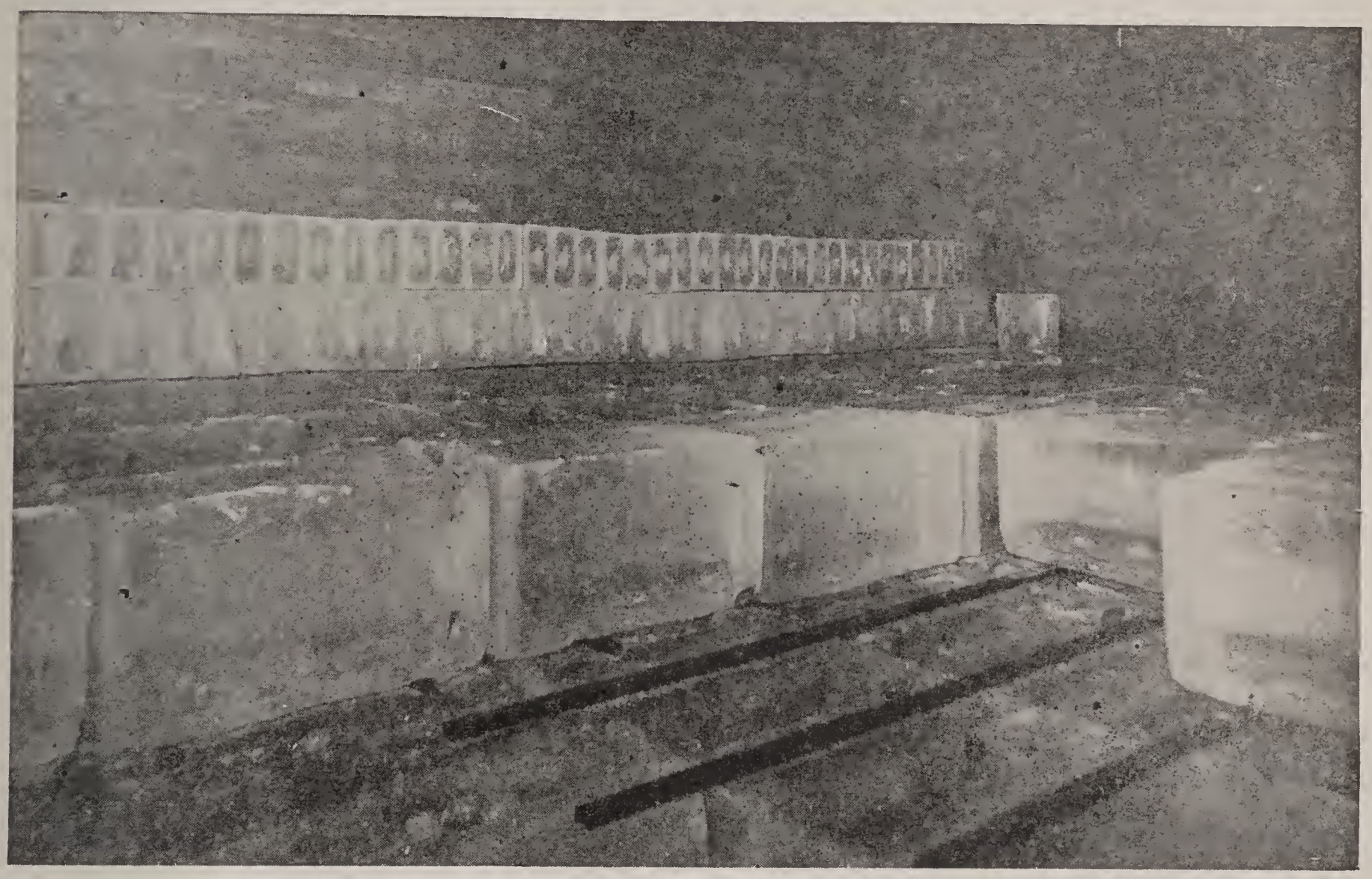
Showing how the ammonia is forced through asbestos covered pipes and kept in circulation in the coils of pipe through the brine into which are placed the tanks of water intended to be frozen.

besides these there are two shorter pipes called the interchanger and the cooler, while an ammonia pump furnishes the power for circulation.

Method of Freezing.

Strong ammonia liquor of 32 degrees Bané intensity is forced by the pump by way of the interchanger, where it is partially heated, up to the top of the still. The still is filled with thirty-six one-inch steam pipes tightly wound with wire. Within the numerous steam pipes are smaller pipes one-fourth of an inch in diameter which carry the steam. When the strong ammonia liquor is emptied at the top of the still it trickles down the sides of the outer pipes, and the wire breaks it up into smaller drops, giving it

larger heating surface. As the ammonia becomes hot it gives off ammonia gas, which rises to the top of the still and passes out by another pipe over to the top of the absorber. This device is also filled with pipes, but they contain circulating water instead of steam. By contact with these pipes the ammonia gas is converted into anhydrous ammonia of exceedingly low temperature, and is ready for the freezing cylinder, which converts it into ice.



VIEW OF THE BLOCKS OF ICE READY FOR DELIVERY TO THE CONSUMERS.

The Ice Machine.

Let us look at the ice machine before we follow the processes of the ammonia plant further. The freezing cylinder, as its name signifies, is a tank 3½x3½x7 feet, filled with water, in which is a hollow cylinder rotating upon hollow trunnions. Through one trunnion the anhydrous ammonia is admitted in quantities enough to allow about three inches to be at the bottom of the cylinder all the time. As the cylinder rotates the ammonia clings to its sides, and thus a thin film at all times is absorbing the heat of the water in the tank outside. The difference of 64 degrees F., as noted before, absorbs so much heat from the water that a thin coating of ice is always forming on the outer side of the cylinder as it rotates in the water. To prevent this ice from getting too thick, a set of knives is arranged so that thin shavings or "spawls" are trimmed off as the cylinder turns. These naturally rise to the top of the water in the tank, and by means of a screw conveyor are carried with some water to hydraulic presses, where under 350 pounds pressure to the square inch they are pressed into cakes. The pipe

leading to the two presses has a three-way valve which automatically closes when one press is full and turns the spawls into the other press. The inside of the presses is of perforated brass, which permits of pressing out all the air and water in the spawls and allows the cakes to issue clear as crystal. With such a plant ten tons of ice can easily be turned out each day.

Work of Anhydrous Gas.

After the anhydrous gas has done its work in the freezer and has grown comparatively warm, it escapes by a pipe through the other trunnion of the cylinder to the top of the absorber. We saw how that in the still the hot gas escaped to the top and was carried to the condenser. As this gas arose a weak ammonia liquor was left behind to trickle down the side of the steam pipes and to collect in a small receiver at the bottom. In order to unite this weak liquor with the spent ammonia gas and thus save waste, it must be cooled somewhat. Accordingly the weak liquor is run off from the receiver at the bottom of the still to the bottom of the interchanger, and by means of a set of spiral coils it rises, because of its heat, and, passing upwards, is reduced in temperature, giving off its heat to the strong ammonia liquor that is on its way to be heated. From the interchanger the cooling ammonia is run downward through coils in the cooler, and by pressure is taken to the top of the absorber, where it meets the ammonia gas from the freezing cylinder. This weak liquor is broken up on the wire coils about the pipes of the absorber, and, just as in the still this allowed the gas to escape when heated, now allows the weak liquor and spent gas to reunite into strong ammonia liquor, whence it goes to the ammonia pump ready for the journey once more through the various cycles back to the freezing cylinder.

The ice crop of the United States for 1899 has been estimated at:

	Tons.
Natural ice, cut from streams	6,000,000
Artificial ice, manufactured ..	8,500,000
Total	14,500,000

Or, in pounds, 29,000,000,000.



HYPNOTISM.

What It May Accomplish—Method of Hypnotizing—Ridiculous Things the Subject is Made to do.

MUCH interest has been taken during the past few years in the results of psychological research and from this has sprung a special concern in hypnotism. Hypnotic suggestion has proved valuable in the treatment of functional disorders of digestion, absorption and circulation, of nervous condition, and it has assumed importance as an appropriate instrumentality for affecting character change in cases of moral obliquity as well as for developing and exalting mind power. Plainly speaking hypnosis implies a mind condition in which the mental action of a sensitive subject is under the control of an operator who has induced the state. It is characterized by insensibility to outward sounds and images, and to ordinary impressions of sense organs, but by quickened perception of sensations pictured by the hypnotist.

Human beings are hypnotizable by other human beings between whom and themselves exists a peculiar sympathy or harmonious relationship known as rapport. Various methods of inducing hypnotism are practiced, all having in view the fixation of the attention upon some monotonous stimulus of the eye or ear, as sedative music or a bright object like the nickel-plated point-protector of a lead pencil, a transparent crystal, a stud in a shirt bosom, or the eyes of the operator. Perfumes also have hypnotic power; the odor of May blossoms, of new mown hay, of balm-of-Gilead firs, contribute to the induction of mental placidness. Certain colors are also helpful, especially pinks of a low chroma.

Use of the Hands.

In certain instances such a procedure as told above may be supplemented by light passes, or by holding firmly the hand of the patient, by pressing it against the forehead of the operator, or by contact of foreheads, while the whole force of one's personality is concentrated in an effort to overcome an automatic resistance to hypnotization.

Some operators request the patient to take a reclining position on a lounge. Then, by talking soothingly to them for some time, the operator acquaints himself with the dominant propensities of controlling thoughts and above all securing the patient's confidence. Then the patient's attention is concentrated upon a suspended diamond, or some other unique article. The eyes soon become tired from the strain, and the patient is told he is gazing at a sleepy stone which has never failed to induce slumber. Then he is told to think of nothing, to renounce the very intention of renouncing mental effort, and to give himself up with a perfect confidence in the purity of the motives of the operator. Under these conditions the eyeballs soon become fixed, a vacant stare replaces the usual intelligent look, and the eyelids begin to open and close spas-

modically. At this stage the suggestion is given that a prolonged refreshing sleep is about to ensue; and in a few moments a long breath is taken and the lids close with a slow regular movement. Deep inspirations follow, and then the operator knows he has secured the deeper personality of his subject.

Gaining Control.

When a person is under the influence of a hypnotist he may be regarded as in a condition in which the part of the nervous system associated with conscious perception is thrown out of gear, without preventing the kind of movements which would result were the apparatus really in action. Impressions are made on the sensory organs; the sensory nerves convey the impression to a part of the brain. In the deepest condition of hypnotism these impressions may not arouse any consciousness, but the result may be the kind of movement which would naturally follow supposing the person had been conscious. The movements of an hypnotic are usually of an imitative kind. The mere suggestion of a movement has not always proved successful. It must be made before the eyes of the person who is expected to perform the movement. The patient is in a sense an automaton played upon by the operator through the medium of the patient's sensory organs. In deep hypnotism the patient has no idea corresponding to the movements he makes to the example of the operator.

In some cases where the patient is but slightly hypnotized there is a curious combination of feelings. He knows he is being made a fool of, but does many ridiculous things at the bidding of the operator. In some respects he is like a somnambulist who acts the movements of a disturbed dream. After coming back to his original self he remembers all that happened while he was in that state. In some cases, however, the hypnotism is so deep as to resemble coma, and in these there is no trace of sensory impressions or of movements.

Experiments Made.

The experiments that have been made with persons who could be hypnotized have been very curious. The hypnotist would tell them to bark like a dog. They would do this. They would be ordered to crawl on their hands and feet as if they were a horse. They would obey. When told to crow like a rooster they made fairly successful attempts to do so. One subject was told to go and touch a stove. The stove was cold at the time, but the hypnotist told the subject it was hot. The instant the stove was touched the subject cried out with pain, having experienced the sensation of heat.

Paul King, a quite noted hypnotist at one time, having gained control of a lady's mind, told her that he was thinking of something that she very much cherished, and for her to go and get it wherever it was. She was at that time in King's studio with a party of friends. She immediately left it in his company and the company of her friends and, still under his influence, went to her home and took from its place on the mantel a portrait of her husband and gave it to King. Experiments like this suggets how far it might be possible for a corrupt person having great hypnotic power to gain control of human minds and influence them for bad. The law has not yet taken cognizance of this phase of hypnotism.

Recent experiments made in New York have led scientists to advance a theory that it would be possible for a hypnotist to cause a subject to die by simply instructing the latter to cease breathing. This would be murder in the eyes of the

law. If this can be done, the suggestion has been made that hypnotism take the place of the eloctrocution chair.

Women, as a rule, hypnotize more easily than men. It is not possible to hyptonize any one without their first mentally consenting or yielding to the influence of the hypnotist.

BRAZIL.

A Rich Agricultural Country—Varied Characters of the Soil—The Inhabitants and Their Religion.

BRAZIL, a Republic in South America, is bounded on the north by Venezuela, British, Dutch and French Guiana; on the east by the Atlantic Ocean; on the south by Uruguay, the Argentine Republic, Paraguay and Bolivia and on the west by Peru and Columbia. Its area is claimed to be 3,209,878 square miles. Its capital is Rio de Janerio. The southeastern portion of Brazil is mountainous, the central, northeastern and western parts consist of a plateau, with the low plains of the Amazon to the north. The principal rivers are the Amazon and its tributaries, Parana and San Francisco, with the Uruguay and Paraguay on the frontiers. Part of the Amazon basin is covered with a dense and rich forest of tropical growths. The principal pursuit of the inhabitants is agriculture. The annual exportations include coffee, sugar, hides, rubber, cotton and tobacco.

The government is a federal republic with a president at its head and having a congress consisting of a senate of 63 members and a chamber of 212 deputies. The country is divided into twenty states and the federal district of Rio

The inhabitants are Brazilians, Indians, negroes, mixed races and colonists from Germany, Italy and Switzerland. The language chiefly spoken is the Portuguese; the religion Roman Catholic. Brazil was discovered by Vincente Yanez



THE BANYAN TREE, SOMETIMES COVERING SEVERAL ACRES.

The northern part of Brazil is famous for its luxuriant vegetation, and many native trees not to be found elsewhere. A great variety of richly flavored nuts are grown in great abundance. The development of this vast country will likely attract the attention of the world during the next several decades.

Pinzon, January 26, 1500, and independently by the Portuguese Cabral in the same year. The country was claimed and colonized by the Portuguese, and was the residence of the exiled Portuguese royal family in the Napoleonic period. In 1822 its independence was proclaimed. An empire was formed with Dom Pedro, son of the Portuguese king, as its first emperor. In 1831 he was compelled to resign and give way to his son, Pedro II. In 1865-1870 Brazil allied with the Argentine Republic and Uruguay, and defeated Lopez of Paraguay. In 1871-1888 slavery was abolished. A revolution broke out in 1889, overthrowing the empire, and compelling the imperial family to leave the country. A provisional government under Fonseca was established. In 1890 a national congress was summoned, and 1891 it proclaimed the Constitution of the United States of Brazil. Fonseca, the first president, assumed control of affairs in 1891, but was compelled to resign. He was succeeded by Peixoto. Revolts have frequently occurred, and in 1893 a serious rebellion of the fleet broke out under Mello.



LARGEST CHRYSANTHEMUM PLANT IN THE WORLD.
Grown in Japan, the home of the flower and valued at $50,000.



EMPEROR'S PALACE AT RIO DE JANEIRO

THE AMERICAN INDIAN.

The Former Occupant of America—Various Tribes and Stocks—Where the Large Reservations are—Numbers Increasing.

THE American Indian was the original occupant of the soil of the North American continent. There were possibly 1,000,000 in what is now the United States when Christopher Columbus came in 1492. There are now about 200,000, of whom less than 50,000 are in the Northwest. The predominant tribes at the present time are the Sioux, Apache, Cherokee, Chippewas, Cheyennes and Shoshones. The original tribes and where they were first located are given herewith:

STOCKS AND TRIBES.	ORIGINAL LOCALITY.
Algonkian,	East Canada and United States.
Abnaki,	Nova Scotia.
Arapaho,	Upper Kansas River.
Blackfeet (Siksika),	Upper Missouri River.
Cheyenne,	Upper Arkansas River.
Chippeway,	Lake Superior.
Cree,	south of Hudson Bay.
Delaware (Lenape),	Delaware River drainage.
Illinois,	Illinois River.
Kaskaskia,	Mississippi River below Illinois River.
Kickapoo,	Illinois River.
Menominee,	Green Bay, Mich.
Miami,	between Miami and Wabash rivers.
Micmac,	Nova Scotia.
Mohegan,	Hudson River.



A FAR WEST TOWN WITH INDIANS IN THE FOREGROUND.

The customary saloon and general merchandise store are shown and the rails of a transcontinental line

STOCKS AND TRIBES.	ORIGINAL LOCALITY.
Montagnais	East Canada.
Manticoke	East Chesapeake Bay.
Narragansett	Rhode Island.
Ottawa	south of Lake Huron.
Passamaquoddi	Maine.
Piankishaw	middle Ohio River.
Piegan	Upper Missouri River.
Pottawattomi	south of Lake Michigan.
Powhatan	Virginia.
Lipan	Rio Grande, Texas.
Loucheux	Lower Makenzie River.
Mescalero	New Mexico.
Montagnais	Central Canada.
Navajo	New Mexico.
Slave	Makenzie River.
Tinne	Northwest Canada and Alaska
Attacapan	Texas coast.
Beothukan	New Foundland.



THE CARLISLE COLLEGE FOOTBALL TEAM.

Composed wholly of young Indians being educated by the United States. The swiftest running football team ever got together.

STOCKS AND TRIBES.	ORIGINAL LOCALITY.
Sac and Fox	Sac River.
Shawnee (Vagrants)	South Central United States.
Athapascan	Alaska, Canada, California, New Mexico.
Apache	New and Old Mexico, and Arizona.
Chepewyan	South Central Canada.
Hupa	North California.
Jicarilla	New Mexico.
Kuchin	Yukon and Copper rivers, Alaska.
Caddoan	Louisiana, Texas, Nebraska, Dakota.
Adaize	Red River, Texas.
Arikara	Dakota.
Caddo	Texas.
Nachitoches	Red River.
Pawnee	Arkansas River.
Wichita	Red River, Arkansas.
Chimakuan	Puget Sound, Washington.
Chimarikan	North California.
Chimmesyan	Northwest British Colombia.

STOCKS AND TRIBES. ORIGINAL LOCALITY.

Nass and Tsimshian, Skeena and Nassac rivers, British Columbia.
Chinookan, Columbia River, Oregon.
Chitimachan, South Louisiana.
Chumashan, California coast, 34 to 35 deg. North.
Coahuiltecan, Rio Grande mouth.
Copehan, North Central California.
Wintun, Trinity River, California.
Costanoan (Mutsun), south of Golden Gate, California.
Eskimoan, Arctic coast.
Esselenian, south of Monterey Bay, California.
Iroquoian, the Great Lakes and Carolina.
Cayuga, south of Lake Ontario.
Cherokee, North Carolina, etc.
Conestoga, South Susquehanna River.
Erie, south of Lake Erie.
Huron, between Lake Ontario and Huron.
Mohawk, East New York.
Neutral Station, west of Niagara River.
Oneida, Central New York.
Seneca, Central New York.
Susquehannock, head of Chesapeake Bay.
Tuscarora, migrated to New York from Virginia.
Wyandot, between Lake Ontario and Huron.
Kalapooian, Willamette River, Oregon
Karankawan, Matagorda Bay, Texas.
Keresan, New Mexico.

STOCKS AND TRIBES. ORIGINAL LOCALITY.

Acoma, Laguna and other Pueblos, New Mexico.
Kiowan, Nebraska and Wyoming.
Kituanahan, East British Columbia.
Kutenay, British Columbia.
Kolushan, Southeast Alaska.
Kulanapan (Pomo), coasts of California, 39 deg. North.
Kusan (Coosan), Coos Bay and River, Oregon.
Lutuamian, Klamath Lakes, Oregon and California.
Klamath and Modoc.
Mariposan (Yokut), Tulare Lake, California.



A PANEL PICTURE OF AMERICAN INDIANS ON THE WARPATH.
Showing their method of riding, their costume and their swift running ponies.

STOCKS AND TRIBES. ORIGINAL LOCALITY.

Moquelumnan, interior of California.
Muskhogean, Gulf States, east of Mississippi River.
Chickasaw, Upper Mobile River.
Chictaw, between Mobile and Mississippi Rivers.
Creek (Muskoki), between Mobile and Savannah rivers.
Seminole, Florida.
Yamasi, South Carolina coast.
Natchesan, present site of Natchez.
Palaihnihan, Pitt River, Northeast California.
Piman, east shore, Gulf of California.
Opata, Sonora, Mexico.
Papago, Rio Gila, Arizona.

STOCKS AND TRIBES.	ORIGINAL LOCALITY.
Pujunan,	East Sacramento River, California.
Maidu,	Sacramento River, California.
Quorateau,	Klamath River, California.

STOCKS AND TRIBES.	ORIGINAL LOCALITY.
Atnah,	Fraser River.
Bellacoola,	British Columbia coast.
Clalla,	Washington State.
Lummi,	Washington State.



A PERFECT TYPE OF THE AMERICAN INDIAN.

Showing a chief in his robes of authority holding his calumet or peace pipe and having his war bonnet and blanket conspicuously displayed.

STOCKS AND TRIBES.	ORIGINAL LOCALITY.
Salinan,	east of California, 35 to 37 deg. North.
Salishan,	Washington, British Columbia and Montana.

STOCKS AND TRIBES.	ORIGINAL LOCALITY.
Nisqualli,	Washington State.
Many tribes with names ending in "ish."	
Sastean,	Middle Klamath River, California.

STOCKS AND TRIBES. ORIGINAL LOCALITY.

Shasta, Klamath River, California.
Shahaptian, Upper Columbia River, Oregon, etc.
Klikatat, Middle Columbia River.
Nez Perce, Middle Columbia River.
Shoshonean, Great Interior Basin.
Bannock, Montana.
Chemahuevi, Colorado River Agency, Arizona.
Comanche, Northern Texas.
Moki (Hopi), Northeast Arizona.
Pai Ute, Utah.
Snake, Idaho and South Oregon.
Ute, Utah.
Siouan, chiefly Missouri River drainage.
Assiniboin, Saskatchewan River.
Biloxi, Mississippi.
Catawba, North and South Carolina
Crow, Yellowstone River.
Dakota, Upper Mississippi River.
Iowa, Iowa River.
Kansas (Kansay), Kansas.
Mandan, Upper Missouri River.
Minnetaree, Yellowstone River.
Ogallala, Missouri River.
Omaha, Elkhorn River.
Osage, Arkansas and Osage rivers.
Otoe, Platte River, Nebraska.
Ponca, Middle Missouri River.
Quapaw, Lower Arkansas River.
Teton, Missouri River.
Tutelo, Roanoke River, Virginia.
Winnebago, west of Lake Michigan.
Skittagetan, Queen Charlotte Islands.
Haida, Queen Charlotte Islands.
Kaigani, Queen Charlotte Islands.
Takilman, Rogue River, Oregon.
Tanoan, New Mexico.
Taos and other Rio Grande Pueblos, New Mexico.
Timuquanan, Florida Peninsula.
Tonikan, Lower Yazoo River, Mississippi.

STOCKS AND TRIBES. ORIGINAL LOCALITY.

Toukawan, West and Southwest Texas.
Uchean, Savannah River, Georgia.
Waiilatpuan, Wallawalla River, Oregon.
Wakashan, Vancouver Island and British Columbia.
Aht, Vancouver Island.
Haeltzuk, British Columbia.
Washoan, Northwest Nevada.
Weitspekan, Lower Klamath River, California.
Wishoskan, Mad and Eel rivers, California.
Yakonan, coast of Oregon.
Yanan, coast of Oregon.
Yukian, Round Valley, California.
Yuman, Lower California and Mexico.
Cocopa, Colorado River mouth.
Diegueno, San Diego, California.
Havasupai, Lower Colorado River.
Maricopa, Gila River, Arizona.
Mohave, mouth of Colorado River.
Zunian, New Mexico.

The last census shows that most of the Indian tribes are increasing in number and not decreasing. The government has opened many Indian schools like that of the famous Carlisle at which the Indian children are educated free of charge. There are also schools on the reservations. The Indians still hold in their own name many million acres of land and quite a number have taken to farming. The great Indian reservations of the country are now in Indian Territory, Oklahoma, Wisconsin, Northern Minnesota, both of the Dakotas, Montana, Wyoming, Colorado, Arizona and New Mexico.

MODERN ART.

Art, What It Is—Various Divisions and What Constitutes Each—Meaning of a Work of Art.

ART is the production or construction of objects. Black art, necromancy, sorcery, is the fancied power of performing wonderful feats by preternatural means, especially means derived from the assistance of the powers of evil. Decorative art is that branch of art which has for its primary object merely the pleasure of the eye, especially in decoration which is subservient to architectural features or to form, as in ceramics. Fine arts are those arts that seek expression through beautiful modes; specifically architecture, sculpture, painting and engraving. Plastic arts, sculpture, including all subordinate or related arts by which objects are represented in the round or in relief. A work of art is anything in the formation or into the accomplishment of which art in any sense has entered.

Some famous modern masters of art and their works are: Henry's Chicago; Wendt's Autumn; Werthener's Lion and Butterfly; Clement's Circassienne; Fery's Niagara Falls; Flagg's Hebe; Turner's Sunset and Reynold's English Maid.

While European artists still lead the world in painting the works of American artists are beginning to attract great attention, not only at home but abroad. A large number of American painters exhibited at the recent Paris Exposition and received various medals of honor. One of the best known American painters whose portraits sold in the galleries of England and France was G. P. A. Healy, who died a short time ago. Mr. Healy's early art work was in Chicago. He ranked as one of the best of modern portrait painters.



THE ATELIER OR STUDIO OF AN ARTIST.

Showing his canvas, method of dress and arrangement of the room.

MEXICO.

Location, Character of Soil—Leading Industries—Early Inhabitants—Principal Historical Events—Present Inhabitants.

MEXICO is bounded on the north by the United States, on the east by the Gulf of Mexico and the Caribbean Sea, on the south by British Honduras, Guatemala and the Pacific Ocean, and on the west by the Pacific Ocean. Its capital is the City of Mexico. It comprises the peninsulas of Lower California and Yucatan, aside from the main portion, and has a complete area of 767,005 square miles. The surface is generally a tableland traversed by high mountain ranges. Silver, gold, copper and lead comprise the principal mineral products. In the north the inhabitants are chiefly engaged in agricultural pursuits and live-stock raising. Sugar, maize, coffee, tobacco and hemp are grown.

Mexico is divided into twenty-seven states, one federal district and two territories. It has a republican form of government (modeled after that of the United States), with a president at the head of the government. It has also a congress (senate of two members from each state, and lower house of 227 members).



A COFFEE PLANTATION IN OLD MEXICO.
Showing tropical foliage and the ruins of an ancient gate.

The early inhabitants were Aztecs and other native races. The present inhabitants are chiefly creoles of Spanish descent, Indians and mixed races, including Mestizos and Zambos. The predominant language is Spanish; religion, Roman Catholic.

The chief events in the history of Mexico are the invasion of Cortez in 1519; conquest of the capital in 1521; the country made a

S



THE CUT OF NOCHISTONGO, MEXICO.

Blasted out of solid rock for railroad passage. The cut is 200 feet deep.

Spanisn colony under the name of New Spain, and after 1535 a viceroyalty; revolution under Hidalgo begun in 1810; guerrilla warfare until the revolution under Iturbide in 1821; last Spanish viceroy deposed in 1821; empire under Iturbide, 1822-1823; secession of Texas, 1836; war with the United States, 1846-1848; after this there were frequent changes of government for some time; foreign intervention in 1861; war with France commenced, 1862; empire under Maximilian upheld by French troops, 1864-1867; French troops withdrawn in 1867; restoration of the republic in 1867.

In portions of Mexico where the rainfall is sufficient the vegetation is rich and of a tropical character. Extensive forests abound in valuable timbers, dyewoods and medicinal plants. There are mahogany, rosewood, copaï, caucho (India-rubber), sarsaparilla and vanilla trees and plants.

The fauna of Mexico is composed of several varieties of the bear, the wolf, coyote, skunk, bison, squirrel, marten,



COTTON MILLS OF HERCULES, MEXICO.

Showing the great court yard.

otter, rattle-snake, mocking-bird and many wild fowl similar to those of northern regions, while the monkey, puma, jaguar, sloth, tapir, alligator, boa, scorpion, tarantula, parrot, trogan identify it with the tropical regions. European domestic animals thrive well in Mexico—cattle, sheep and horses being found on the ranches of the northern states.



A TROPICAL ROAD THROUGH A COFFEE PLANTATION.
Near Cordova, Old Mexico; tropical foliage shown.

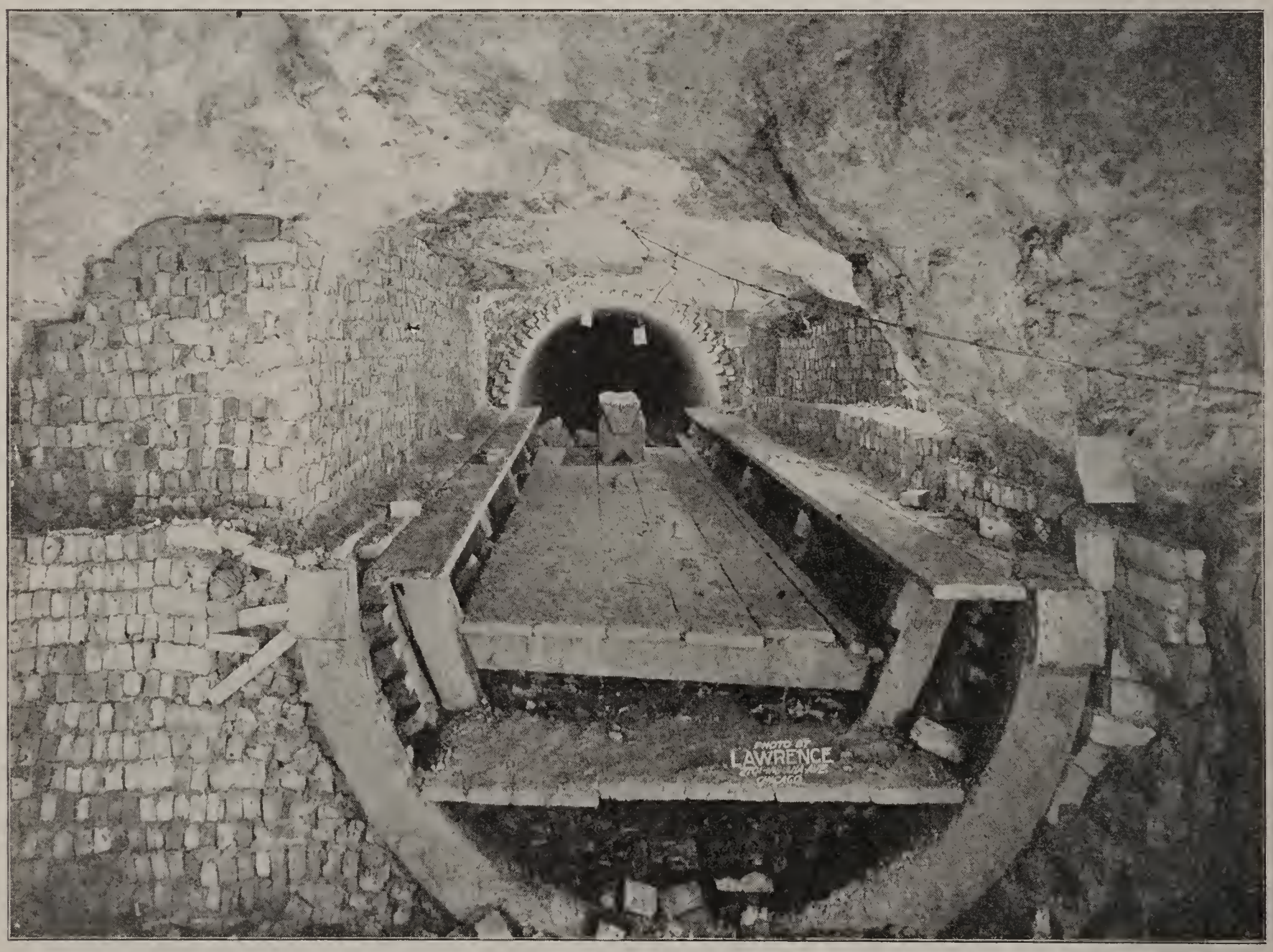
The city of Mexico, the capital, is the largest and finest in all Spanish-America. Its streets are broad, well paved and lighted. Here is a cathedral, one of the largest in America, founded in 1573 and completed in 1657. And here too are picture galleries, convents, schools and libraries whose age and history make them points of interest and instruction, as well as fascination. The industries of the City of Mexico are varied, its climate equable, but its drainage not very good. The city dates from either the year 1325 or 1327 when the Aztecs first gathered there in the form of a settlement. With the advent of the Spanish in 1519 the city became the scene of many revolutions but since the death of Maximilian peace has been restored and Mexico has become a city of refining and civilizing influence over the natives.



WATER SUPPLY.

How a Great City Drinks—Underground Tunnels Built—Lake Supply is Drawn Upon—Billions of Gallons Used Annually.

THE city of Chicago contains one of the most wonderful water-works systems in the world, and may be used as an illustration of how the many people in the large cities are supplied with their drinking and bathing liquid, as well as fire protection. The city of Chicago draws its water supply from Lake Michigan. Buildings are erected in the lake, two, four and six miles from the shore line. These buildings have foundations which extend to the bottom of the lake and below that bottom fifty, sixty and seventy feet. At the bottom they connect with underground tunnels built from the land. The



A HALF SECTION OF AN UNDERGROUND WATER TUNNEL OF THE CITY OF CHICAGO

Through this the water used by the city is conveyed from Lake Michigan.

water which the city is to drink goes into these buildings, which are called cribs, and passes through gratings to the tunnels. The gratings are used to keep out floating timbers, debris and ice.

The water flows through these tunnels to the land, where there are pumping stations. The pumps of these stations gather this water up and force it into the mains leading through the streets. These mains or pipes convey the water to the private residences. Hydrants, or upright pipes, are placed at the various street corners, and these connect with the mains and are used for fire engines. Since the construction of the drainage channel, which carries all of Chicago's sewage away from the lake, the city has secured one of the best water supplies in the world. The pumping engines of the city each furnish 20,000,000 gallons of water a day when in service. The city, which has 2,000,000 inhabitants, uses about 90,000,000,000 gallons of water a year. It has nearly 2,000 miles of water mains or pipes. Each one of its fire engines has a capacity for pumping 1,100 gallons of water per minute upon a fire. The water department pays its own expenses through its revenue from the water it sells. The city owns the water plant, and this plant is a practical illustration of the value of municipal ownership.



PANORAMA OF THE LAKE FRONT, CHICAGO.

But a few years ago a part of the lake.

THE LARGEST LOCOMOTIVE.

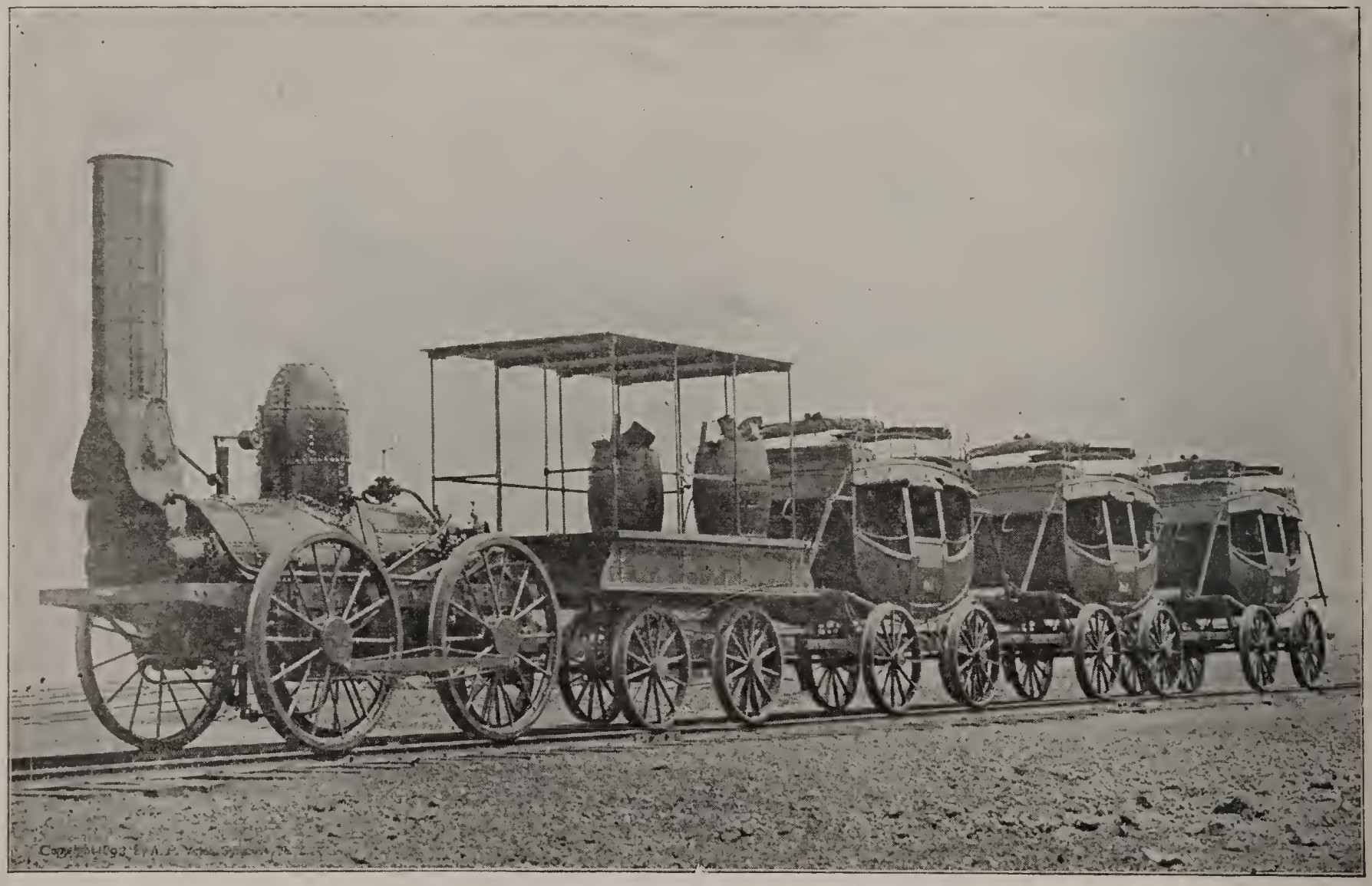
Where Built and How it Compares With Other Engines—Dimensions and Capacity —Some Rivals.

THE illustration on page 280 shows the gigantic proportions of the engine that holds the world's record for size, weight and power. It was built by the Pittsburg Locomotive Works for the Pittsburg, Bessemer and Lake Erie Railroad. The table on p. 279 is a comparison with the three other next largest engines showing how much this surpasses them.

Engine 151 is meant for hauling exceptionally heavy loads of ore and iron at moderate speed. Its net hauling capacity on a level track is 7,847 tons. When the engine is working to its full power there is a pull on the draw bar of 56,300 pounds.

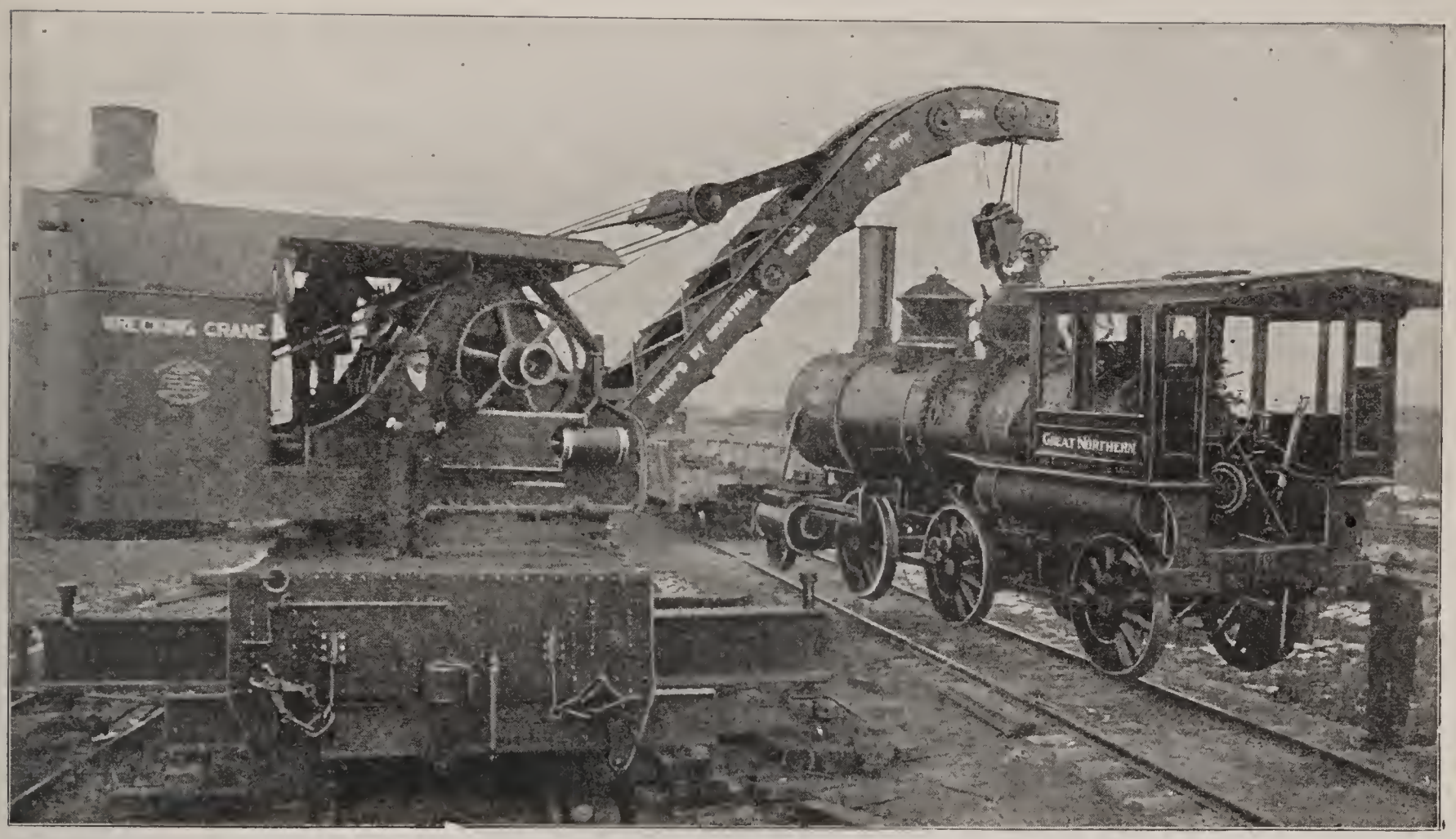
A Rival Monster.

All the great railway systems of this country are after big locomotives. This is a picture also of a type of Illinois Central locomotive that came from



THE FIRST RAILWAY IN AMERICA.

Not constructed for fast travel, comfort, nor heavy hauls. The engine, though, was called the "Rocket."



A GIANT WRECKING CRANE.

Used in moving great masses of iron and steel. It is now lifting a derailed locomotive to the track.

the shops. When it first touched the rails it was the biggest locomotive in the world, but so rapid has been the increase in size of these mechanisms that there is now at least one, if not others, larger.

Railroad.....	P. B. & L. E.	Union Railroad.	Illinois Central.	Lehigh Valley.
Builders.....	Pittsburg	Pittsburg	Brooks.	Baldwin.
Size of cylinders..	24 x 32 in.	23 x 32 in.	23 x 30 in.	18 and 30 x 30 in.
Total weight.....	250,300 lb.	230,000 lb.	232,200 lb.	225,082 lb.
Weight on drivers.....	225,200 lb.	208,000 lb.	195,200 lb.	202,232 lb.
Total weight of engine and tender.....	391,400 lb.	334,000 lb.	364,900 lb.	346,000 lb.
Tractive power based on 25 per cent of adhesive weight....	56,300 lb.	52,000 lb.	48,300 lb.	50,558 lb.
Net hauling capacity on level at 10 miles per hour.....	7,847 tons.	7,261 tons.	6,717 tons.	7,049 tons.
Ratio of tractive power to adhesive weight....	4	4	4	4
Percentage of efficiency.....	100	92.5	85.6	89.8

Still, so far as bigness is concerned, this monster, which is now hauling freight on the Illinois Central, will serve as a capital illustration of what the skilled mechanics of to-day can do.

The mathematics of this locomotive are: Cylinders, 23 inches by 30 inches stroke; the driver are 57 inches, or nearly 5 feet in diameter; the boiler front end is 82 inches in diameter; the weight on the drivers is 193,200 pounds, on the trucks, 39,000 pounds, total engine weight, 232,200 pounds; the tender load is 132,700 pounds; the manufacturing company is the Brooks; the total weight of the engine and tender is 364,900 pounds; the tractive power, based on 25 per cent of adhesive weight, is 48,300 pounds, and the net hauling capacity on the level is 6,717 tons.

This locomotive will easily haul sixty loads under oirdinary conditions and sixty-five or more under extraordinary conditions. The Pittsburg, Bessemer and Lake

Erie road has secured two larger engines of the same consolidation type. They have a total weight of engine and tender of 391,400 pounds, or a weight on drivers of 225,200 pounds and on truck wheels of 25,100 pounds, or total engine weight of 250,300 pounds; the cylinders are 24 inches in diameter and the piston stroke 32 inches; the diameter of the drivers is 54 inches; the working pressure



THE LARGEST LOCOMOTIVE IN THE WORLD.

Owned by Pittsburg, Bessemer & Lake Erie road. Can haul eighty loaded cars of freight over a thirty-six foot to the mile grade.

of the boilers is 220 pounds; the fire-box has a length of 132 inches, a width of 40¼ inches. These locomotives are to be used in ore and iron traffic, their duty being to haul great train loads at moderate but regular speed.

Mountain Giants.

The Union Pacific has secured some monster engines, having a total weight of 334,000 pounds each and with great capacities for work on the mountain grades of the line. The Northwestern, the Burlington and the Rock Island railroads are making extensive additions of big locomotives to their systems, some for freight hauls and others for passenger traffic. That the biggest locomotive which can be safely and economically handled has yet been constructed master mechanics do not believe. The limit line is some distance away, but with the western roads pushing fast to reach it. The master mechanics of a number of roads have commissions from their companies to exert themselves in devising plans for improved locomotives of a maximum capacity, and they are working each to outstrip the other. The tendency of the time in this direction is not so much toward high-speed locomotives as for those having great hauling capacity.

BUSHMEN.

Strange Aboriginals of Africa—Semi-Savage Tribes—They Live in the Interior—Strange Habits and Customs.

THE Bushmen of Africa are also called San. The language of the San is evidently a sister branch of the Khoikhoin, the name applied to the Hottentots. It is poorer and less regular in grammatic forms than the Khoikhoin language, but richer in clicks. The dialects diverge considerably. The Bushmen are known by different names, according to the Bantu tribes, on whose skirts they live. Thus they are known to the different tribes as Aba-tua, Ba-rua. The names Ba-tua, Ba-kua, and Ba-tshua are most generally given to the Pygmies and Bushmen from Galla-land to the Cape Owing to the fact that the Pygmies and Bushmen speak the dialects of their Bantu neighbors, most of the Pygmy vocabularies given by travelers are



A TRIBE OF BUSHMEN OF THE INTERIOR OF AFRICA.

Having a dialect peculiar to themselves. They are composed of many tribes.

Bantu. The principal Bushmen tribes are the Ba-Bumantsu in Basutoland; the Ba-Lala in Bechuanaland; the Ma-Denassana, serfs of the Ba-Mangwato, of Chuana stock; the Ma-Sarwa in the Kalahari desert; the Ba-Kankala in the Kunene valley; and the Ba-Kasekele northeast of them. It is not yet settled whether the Ba-Kuise, Ba-Kuando and Ba-Koroka, near Mossamedes, southern Angola, are Bushmen or degenerated negroes.

WEIGHTS AND MEASURES.

STANDARD of measure is a brass scale 82 inches in length, and the yard is measured between the 27th and 63d inches of it, which, at temperature of 62 degrees, is a standard yard.

LINEAL.

12 inches = 1 foot.
3 feet = 1 yard.
5.5 yards = 1 rod.
40 rods = 1 furlong.
8 furlongs = 1 mile.

GUNTER'S CHAIN.

7.92 inches = 1 link.
100 links = 1 chain, 4 rods, or 22 yards.
80 chains = 1 mile.

ROPES AND CABLES.

1 fathom = 6 feet.
1 cable's length = 120 fathoms.

Standard gallon measures 231 cubic inches, and contains 8.338,582,2 avoirdupois pounds, or 58.372 Troy grains of distilled water, at temperature of its maximum density, 39.10, barometer at 30 inches.

Standard bushel is the Winchester, which contains 2,150.42 cubic inches, or 77.627,413 pounds avoirdupois of distilled water at its maximum density. Its dimensions are 18.5 inches diameter inside, and 8 inches deep; and when heaped, the cone must not be less than 6 inches high, equal 2,747.915 cubic inches for a true cone.

A struck bushel contains 1.244,45 cubic feet.

NAUTICAL.

1 ton displacement in Salt water = 35 cubic feet.

1 ton registered internal capacity = 40 cubic feet.

DIMENSIONS OF A BARREL.

Diameter of head, 17 inches; bung, 19 inches; length, 28 inches; volume, 7,689 cubic inches, or 3.5756 bushels.

MISCELLANEOUS.

1 cubic foot = 7.480,5 gallons.
1 bushel = 9.309,18 gallons.
1 chaldron = 36 bushels, or 57.244 cubic feet.
1 cord of wood = 128 cubic feet.
1 perch of stone = 24.75 cubic feet.
1 quarter = 8 bushels.
1 load of haw or straw = 36 trusses.

WEIGHT OF MEN AND WOMEN.

The average weight of 20,000 men and women, weighed in Boston in 1864, was: Men, 141.5 pounds; women, 124.5 pounds. Average of men, women and children, 105.5 pounds.

WEIGHT, FINENESS, ETC., OF U. S. COINS.

Denomination.	Weight of Coin.		Weight of Pure Metal.
	Oz.	Grains.	Grains.
Gold.			
Dollar.....	.05375	25.8	23.22
Quarter Eagle	.134375	64.5	58.05
Three Dollar	.16125	77.4	69.66
Half Eagle	.26875	129	116.1
Eagle	.5375	258	232.2
Double Eagle.....	1.075	516	464.4
Silver.			
Dime.....	.080375	38.58	34.722
Twenty Cents	.16075	77.16	69.444
Quarter Dollar....	.2099375	96.45	86.805
Half Dollar	.401875	192.9	173.61
Trade Dollar.....	.875	420	378
Silver Dollar	.859375	412.5	371.25

Copper and Nickel.

	Weight.	Copper.	Tin and Zinc.
	Grains.	Per cent.	Per cent.
One Cent.....	48	95	5
Two Cents.....	96	95	5
Three Cents.....	30	75	25
Five Cents.....	77.16	75	25

Standard of gold and silver is 900 parts of pure metal and 100 of alloy in 1,000 parts of coin.

Fineness expresses quantity of pure metal in 100 parts.

Remedy of the mint is allowance for deviation from exact standard fineness and weight of coins.

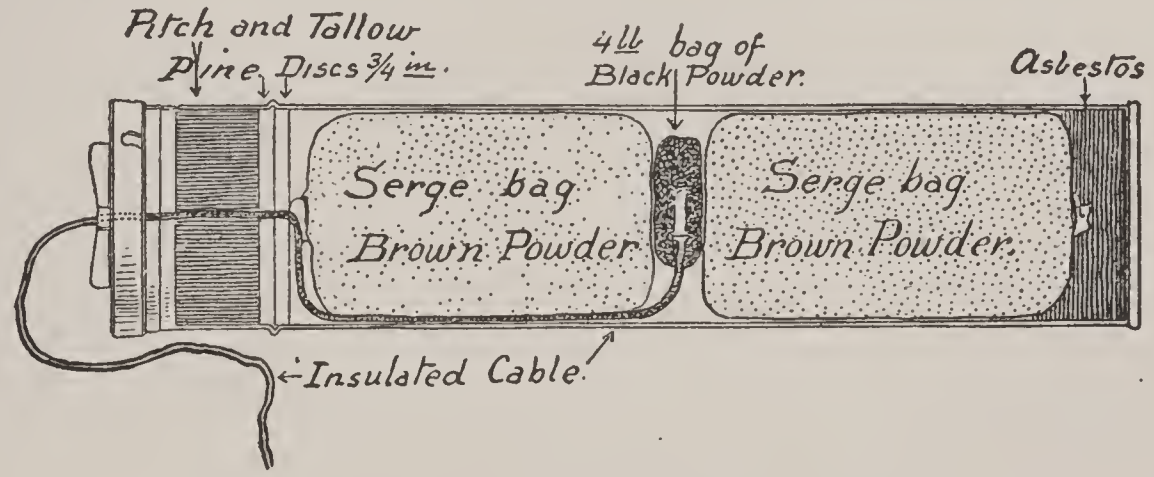
Pure gold, 23.22 grains = $1.00. Hence value of an ounce is $20.67.183+.

Standard gold, $18.60.465+ per ounce.

FIRING A BLAST.

How the Torpedo is Made—Some Knowledge of Chemicals Necessary—Much Care Required—Premature Explosions to be Feared.

IN the old days in firing a blast miners simply laid a train of powder from the charge to a safe distance, then lit this train and fled for safety. Sometimes an explosion followed and sometimes it did not. The modern method is much quicker and safer. An insulated electric cable connected with a battery located some distance from the blast is placed in a cartridge. This cartridge contains two bags of brown powder. The base of it is asbestos, to prevent the contents from being overheated during transportation. The firing end it covered with pitch and tallow and a pine disk to prevent the moisture from getting in. When it is desired to have a blast, the cartridge is inserted in a prepared hole, a key on the electric battery is touched, the electric spark flies along the cable, the powder is set on fire, and the discharge follows. These cartridges rarely prematurely explode. But, like all explosives, they must be handled with care.



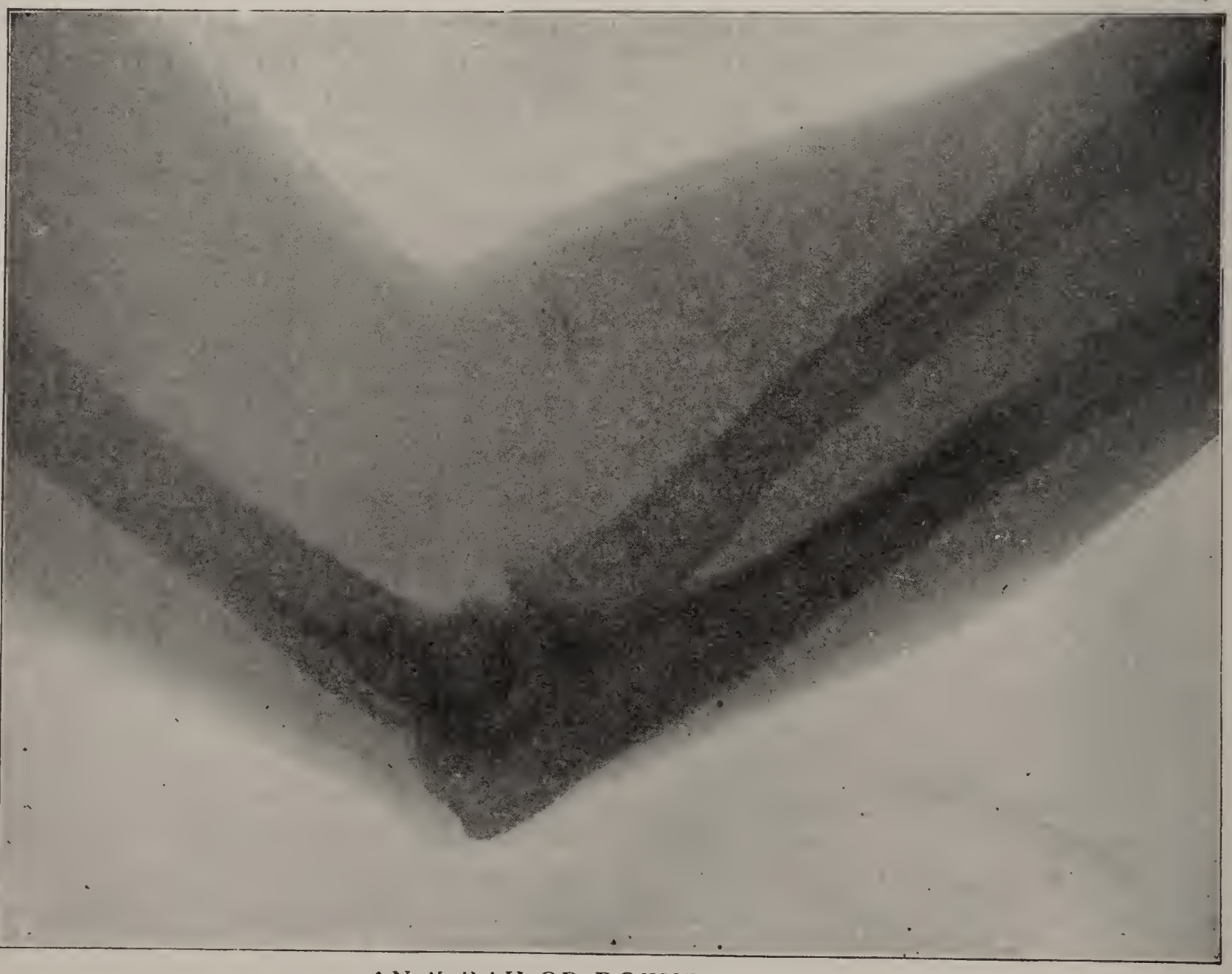
MODERN CARTRIDGE USED IN FIRING BLASTS.

It contains two bags of brown powder, the base of the cartridge being of asbestos and the firing end covered with pitch, tallow and a pine disk.

THE X RAY.

Penetrates the Body—Used by Physicians In Determining Nature of Internal Troubles—Apparatus Used.

FOR years it was difficult for science to determine the exact nature of internal ailments of human beings. Until recently it has not been possible for the physician to see the interior of the lungs, to trace the final location of a bullet, to determine just where a bone was fractured, to find lesions, or muscular troubles. It it now possible to examine the internal structure of the body through the discovery of the Roentgen X-ray. This is nothing more or less that a powerful electric light forced by apparatus through the body so that the interior is revealed to the naked eye. It has been possible to use the X-ray so that a bullet lodged in the heart of a man was not



AN X RAY OR ROENTGEN RAY.

Upon the bones and joint of the arm, showing the elbow socket and covering of flesh.

only photographed before it was removed, but was then taken out and the man still lived. This operation was performed in Chicago three years ago.

Broken ribs have been discovered with this powerful light, and the location of pins and needles which have got into the body somehow. The condition of the lungs may be determined and foreign growths be found. The use of the X-ray is not objectionable nor painful to the patient, and has advanced the art of surgery a thousand years. It is one of the most wonderful discoveries of the nineteenth century, and is now used in all of the principal hospitals of the United States and Europe.

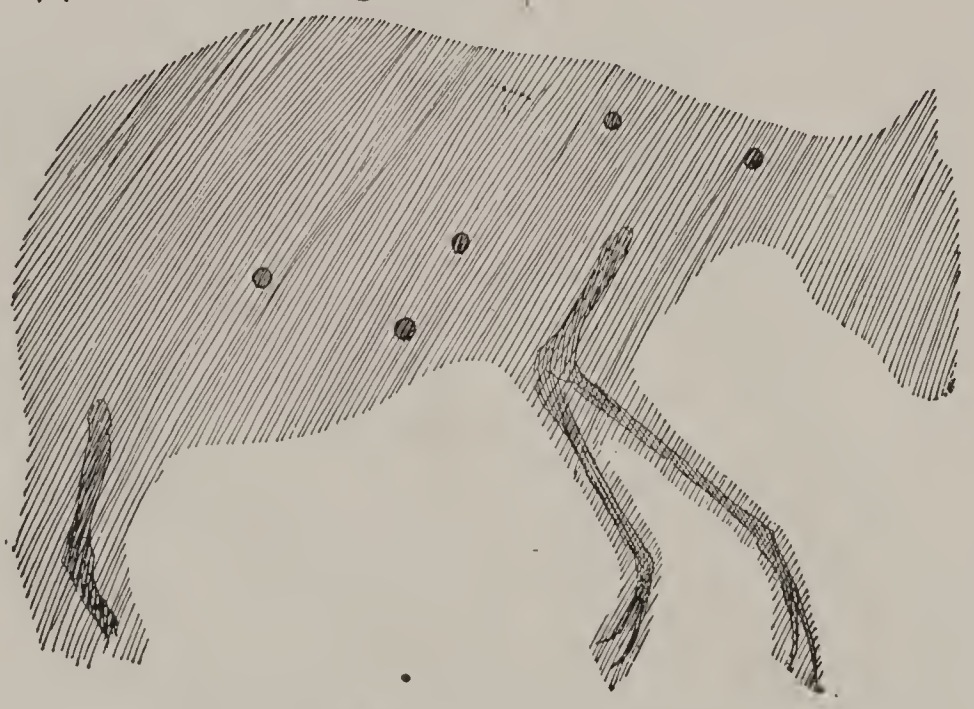
For developing the electrical force necessary to produce the X or electrical ray a static electric machine may be used. The current developed is passed through a Crookes' tube, which is applied to that part of the body desired to be illuminated. Over the part of the body illuminated by the ray is placed a flouroscope. This flouroscope is nothing more than a photographer's cap which fits closely to the eyes of the operator and shuts out light. The operator is then enabled to see the illumination upon the body of the patient and to examine the desired parts. The static electric machine when developing the X-ray is making from 1,200 to 1,500 revolutions per minute. In the first use



THE ROENTGEN OR X RAY.

Showing how it reveals the bones and joints of the hand and wrist. The shadow seemingly upon them is the flesh.

made of the X-ray there was great danger of severely burning the patient with the electrical current developed. This has now been obviated through the use of the static machine. The Crookes' tube was invented by Sir William Crookes of England. He was a noted chemist. He discovered thallium in 1861, and invented the radiometer in 1874. He was knighted by the queen in June, 1897. It is now possible with the X-ray, if a person has swallowed a button, or a bone is lodged in the throat, or foreign and injurious substances are introduced into the body, to readily see the same and to remove them with less injury to the body than ever before.



PHOTOGRAPH OF A SHOT INSIDE OF A RAT'S BODY

DENTAL SURGERY.

Importance of Care of Teeth—Effects of Bad Teeth—Dental Surgery a Science.

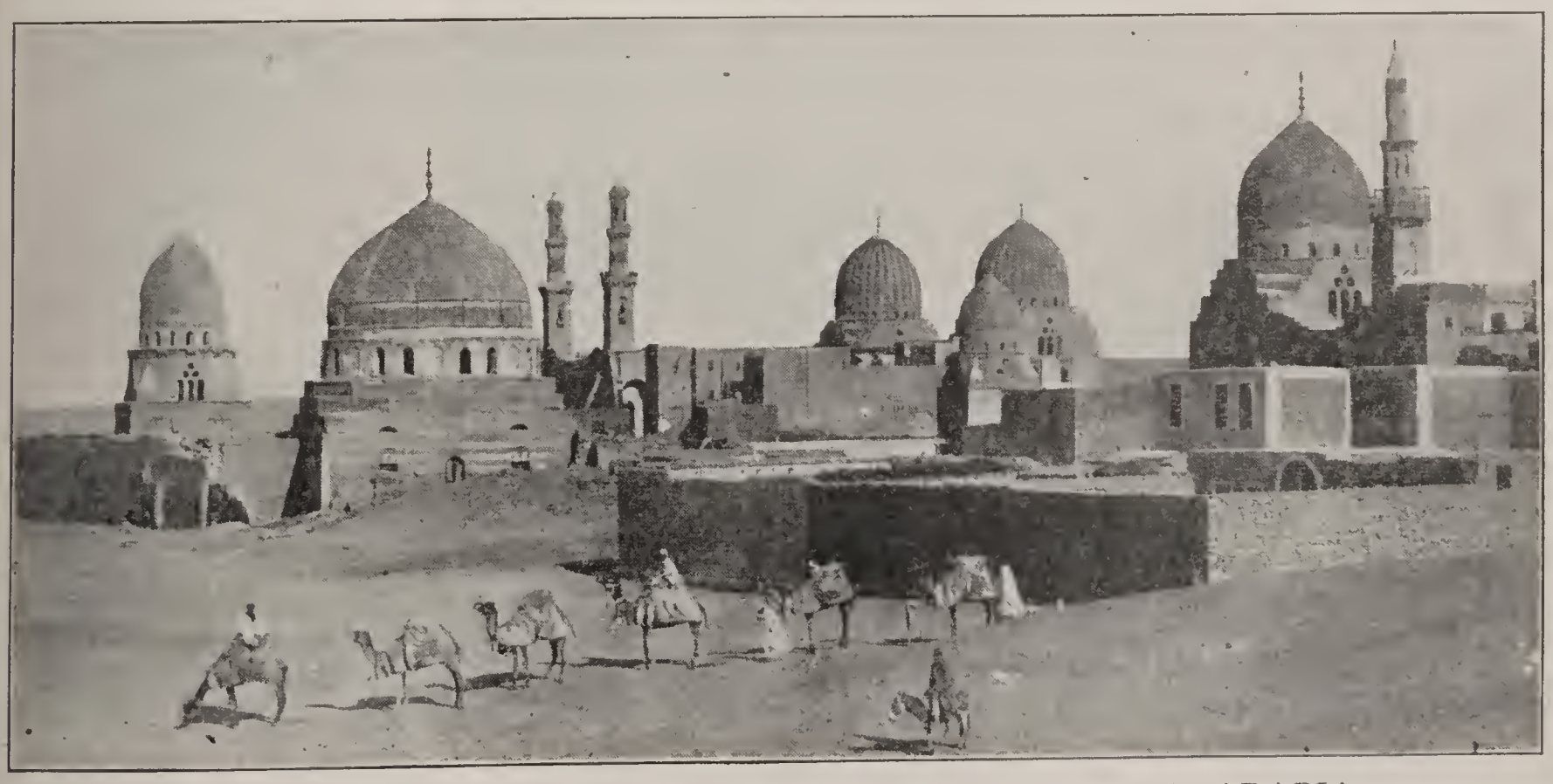
THE care of a mouth is now considered to be one of the first duties of a human being. It is known that a bad condition of the teeth seriously disturbs the stomach, may affect the eyesight, may injure the hearing, produces headaches, and often leads to general bad health. Dental surgery is becoming a science of the first class, and it is now possible to have much of the mouth treated with very little pain on the part of the patient, or any of the excruciating shocks of olden times. Large dental schools are to be found in all of the great cities, and in these students work learning the structure of the mouth and how to extract or rebuild the teeth.

They take the same kind of a course of study one would in mastering any other profession in college, and when graduated receive diplomas. Many of these dental schools contain 400 or 500 pupils. But as every person in ordinary health has thirty-two teeth in his head, it can be understood that the supply of good dentists is rarely too great. The people of the United States are said to put more money into their teeth than any other people in the world. Among the poor in Europe dentistry has made very slow progress.

BAGDAD.

Once a City of Great Importance—The Center of Arabic Culture and Learning—An Important Commercial Point.

BAGDAD, the Persian name meaning "Gift of God," is the capital of the province of Bagdad. The province of Bagdad is located in the lower valleys of the Euphrates and Tigris, between Persia and Arabia. The city of Bagdad was formerly an important one, and is still quite a commercial point. It was founded in 762 by Abu Jaffar, called "Al-Mansur," "the Victorious." Abu Jaffar was the second calif of the dynasty of the Abbassides, and Bagdad remained the capital of the Abbassides for five hundred years. During that time it bore the name Mansurijeh, also Dar-es-Selam, meaning "Dwelling of Peace." Under the Abbassides it became the center of Arabic learning and civilization, and the glory of the eastern world. When it was most prosperous, its walls harbored as many as a million and a half of people. With the fall of the Abbissides dynasty, Bagdad declined and fell into the hands of the Mongols in 1258.



TOMBS OF THE CALIPHS OF BAGDAD, AT PORT SAID, ARABIA.
Just on the Suez Canal, and Caravans in the foreground entering the desert.

THE ALPS.

The Most Extensive of Europe's Mountain Systems—Ancient and Modern Divisions—Some High Peaks.

THE most extensive mountain system in Europe is the Alps. It comprises a part of southeastern France, a part of northern Italy, a part of southern Germany, the western part of Austria-Hungary, and most all of Switzerland. The ancient division of the Alps were the Maritime, Cottian, Graian, Pennine, Rhaetian, Noric, Carnic, Venetian and Julian Alps. It is now divided into Western, Central and Eastern Alps. The western Alps include the Ligurian Alps, Maritime Alps, Cottian Alps, Graian Alps, Montagues des Maures and Esterel Mountains, Mountains of Provence, Alps of Dauphine, Limestone Alps of Savoy, and the mountains of Chablais and Faucigny. The central Alps include the Pennine Alps, Lepontine Alps, Rhaetian Alps, Otzthaler Alps, Bernese Alps, Fribourg Alps, Emmenthal Alps, Urner and Engelberg Alps, Todi range, Schwyzer Alps, St. Gall and Appemzell Alps, Vorarlberg and Allgau Alps, North Tyrolese, and Bavarian Alps, Luganer Alps, Bergamasker Alps, Ortler Alps, Nonsberg Alps, Adamello Mountains, and Tridentine Alps. The eastern Alps include the Zillerthal Alps, Hohe Thuern, Niedere Tauern, Carinthian and Styrian Alps, Styrian Nieder Alps, Kitzbuhler Alps, Salzburg Alps, Upper Austrian Alps, North Styrian Alps, Lower Austrian Alps, Lessinian Alps, Cadoric Alps, Venetian Alps, Carnic Alps, Karawanken, Bacher and Santhaler Alps and Julian Alps.



GALLERY OF THE AXENSTRASSE, SWITZERLAND.

Looking toward Flulen, a natural cavern in the mountain side, much resorted to by tourists.

There are also va-

rious outliers of the system in Hungary and Croatia. The length of the range from the Pass of Giovi, north of Genoa, to Semmering Pass is over 600 miles, and its width is from 90 to 180 miles. Its highest peak is Mont Blanc, 15,781 feet, on the borders of France and Italy; its average height is about 7,700 feet. Its largest glacier is the Aletsch, about thirteen miles long.

BASCULE BRIDGES.

Materials Used in Bridge Construction—The Largest Stone Arch Known—The Bascule Bridge Proper.

BRIDGES are made of various materials, principally stone, iron and wood, and in a great variety of forms. In an arch, or arched bridge, the passage or roadway is carried by arch or arches, which are supported by abutments or by piers. Such bridges are constructed of brick, stone, iron, steel or wood. Brick is seldom used alone, except for comparatively small spans and for unimportant work when stone cannot readily be obtained. In more important work it is often combined with stone, which is introduced to bind, to distribute pressure, to protect the more exposed portions, and for architectural effect. Stone, wherever it can be used, is the most valuable material, on account of its massiveness, stability of form and resistance to the elements. It is, however, inferior to iron in economy, facility of construction and ready adaptability to various situations.



A ROPE BRIDGE OF THE ANDES MOUNTAINS, SOUTH AMERICA.

Held in place by guy ropes and spanning a deep gorge. Constructed by natives.

T

Among the finest monuments of antiquity are ranked the remains of Roman arched stone bridges. The largest stone arch known is that of the bridge of the Washington aqueduct over the Cabin John Creek ; span, 220 feet ; rise, 57.25 feet. The first arched bridge built of iron was erected over the River Severn, in England, and consists of five parallel ribs of cast-iron, with a span of 100 and a rise of 40 feet. The Southwark bridge over the Thames at London, the central one of the three arches of which has a span of 240 with a rise of 24 feet, formerly ranked as the largest iron arched bridge ; but this span has since been more than doubled, as notably in the bridge over the Mississippi at St. Louis, and the Washington bridge over the Harlem River in New York.

Arch Beam Bridges.

In an arched beam bridge arched beams in compression constitute the principal members and sustain the load. The beams are sometimes built of parallel layers of planks, which are made to break joint. In the more important constructions the arches are often compound. They have been employed in modern bridges of considerable magnitude. An arched-truss bridge is a form in which the compression member is an arched beam, as in the McCallum truss. In a beam-truss bridge the load is supported by beam-trusses or openwork beams. A compression-cord and a tension-cord are essential, and the stresses are transferred from one to the other on their way to the points of support by means of struts and tension-bars, which together are called web-members.

A bascule bridge is a drawbridge arranged with a counterpoise, so that as the floor of the bridge is raised the counterpoise descends into a pit prepared for it ; the commonest form of medieval drawbridge.

Movable Bridges.

Swing bridges are by far the most commonly employed of movable bridges. The large rivers to be crossed in America have demanded swing bridges of great span, with excellent contrivances for minimizing friction and insuring steadiness when closed. The swing bridge over the Raritan, in New Jersey, allows two free passages, each 216 feet wide. It is what is known as a double swing bridge—the bridge being balanced on a central pivot assisted by a system of rollers—opening and closing the two passages at once, and affording two passages instead of only one, as in the earlier bridges, which were generally made in two leaves to cross single passages. The Kansas City Bridge crosses two passages, each 160 feet wide. The total moving weight is 303 tons. The bridge is opened by steam power in about one minute and a half, or by manual power in two minutes. From two-thirds to three-fourths of the moving weight rests on the central pivot.

Movable bridges, sometimes called telescope bridges, capable of being rolled horizontally backward, or in an oblique direction, are occasionally employed. The bridge across the Arun, near Arundel, is 144 feet long. It is traversed on wheels and acts as a sliding cantilever, the overhanging portion resting on the opposite abutment when in place.

THE SUEZ CANAL.

First Conception of the Canal—Error Made in Calculation—De Lesseps' Undertaking a Success—Cost and Extent of Canal.

THE Suez Canal connects the Mediterranean with the Red Sea. It was the idea of Napoleon the First to build a canal connecting these two seas, but he abandoned it with the report of the engineer Lepere in 1798, who placed the surface of the Red Sea nearly thirty feet higher than that of the Mediterranean In 1841 this error was corrected by British officers, and in 1849 Ferdinand de Lesseps began a thorough investigation of the isthmus.

Obtaining the consent of the Khedive of Egypt and the Porte, he organized the Universal Company of the Maritime Suez Canal in 1856. Half the capital of this company was raised by public subscription in Europe, chiefly in France, the other half was furnished by the Khedive of Egypt. April 25, 1859, work was commenced on the canal, and November 16, 1869, it was opened for navigation. The work of construction cost about $100,000,000. The canal is 100 miles long, traverses Lake Menzaleh, Lake Timsah, and



PORT SAID SHOWING THE SUEZ CANAL.

This canal connects the Mediterranean and Red Seas, is 100 miles in length and cost $100,000,000.

Bitter Lakes, and was originally from 150 to 300 feet wide at the water surface and 72 feet wide at the bottom, with a minimum depth of 26 feet. Since 1886-1890 it has been deepened to 28 feet and considerably widened. In 1875 the British government purchased of the Khedive his shares in the Universal Company of the Maritime Suez Canal.

The following table shows the increase in the number of vessels passing through the canal and the receipts of the company:

Year.	No. of Vessels.	Tonnage.	Receipts.
1870.....	486	654,915	$ 1,031,865
1880.....	2,026	4,344,519	8,147,885
1890.....	3,389	9,749,129	13,402,180
1894.....	3,352	11,283,855	14,755,365
1895.....	3,434	11,833,637	15,620,745

HISTORY OF AMERICAN FLAG.

Resolutions Adopted by Congress—What Stars and Stripes Mean—First Adoption.

JUNE 14, 1777, Congress in session at Philadelphia, adopted the following resolution:

"Resolved: That the flag of the thirteen United States be thirteen stripes, alternate red and white; that the union be thirteen stars, white in a blue field, representing a new constellation."

The idea of the thirteen stripes was not entirely new, for the Philadelphia Light Horse had used it in the early part of 1775, and at Washington's headquarters at Cambridge, when he took charge of the army, January 2, 1776, there was in use a flag with thirteen stripes just as they are to-day. There is no record, however, of the white stars in a blue field prior to the resolution of June, 1777.

It is not known just to whom credit is due for designing the American standard, but the descendants of Mrs. John Ross, of Philadelphia, assert that she, with the aid of General Washington, first combined the stars and stripes after a design drawn at her suggestion by him. The flag was not officially ordered by the Secretary of State until Sept. 3, 1777, but it is known that the stars and stripes were born by the victorious American army in the Battle of Brandywine, and was ever after carried by the American forces.

The Ranger, commanded by Capt. John Paul Jones, was the first American ship bearing the flag of the Union to receive the salute of a foreign power. The salute was paid by the French, February 14, 1778. April 4, 1818, after a number of new States had come into the Union, Congress passed a law by which, on the admission of every new State, one star was added to the union of the flag.

RAISING OF CHICKENS.

The Business Has Become Profitable—The Incubator and its Wonderful Results—Heating by Hot Water and Hot Air—Winter Care of Fowls.

OF recent years the business of raising chickens and other fowl has assumed proportions throughout the country that bids fair to rival many of the great industries of the agricultural districts. With the modern incubator the work of the poultry farmer has been greatly facilitated, and the art, for such it may be called, is made much more tempting from a financial point of view.

The practice of artificially hatching chickens has been in vogue in Egypt for a couple of centuries. The American inventor, however, has greatly simplified the process. There are two classes of apparatus to-day—one heated by hot water and the other by hot air. The eggs are put on trays and placed in the incubator directly beneath the tank which furnishes the heat. These artificial hens are built double-walled and the intervening space is packed with asbestos to prevent a sudden change in temperature from affecting the inner chamber. The capacity of incubators ranges from 25 eggs to 600, and the manipulators are most successful during the fall and spring, the hot months presenting unprofitable results.

It requires twenty-one days for eggs to hatch, and the temperature is maintained at 103 degrees. After hatching, the chickens are permitted to remain from twenty-four to thirty-six hours in the incubators to dry, and are then transferred to brooders, which hold from 100 to 3,000 chickens. On some farms the chickens are retained in the brooders until ten weeks old. The hatching of chickens is the easiest part. It is the watching necessary to bring the chicks to a marketable age that is the greatest labor.

Real estate is an important factor in poultry farming. Much may be obtained from twenty acres of ground. It is not advisable to put more than one hundred and forty chickens on an acre. This may be divided into four yards with about thirty-five in each yard. Adjoining each should be a scratching-shed, ten by fourteen feet, under which the chickens may exercise. During the winter the floor should be covered with three inches of hay and the grain thrown on this, thus forcing the chickens to exercise in order to get their food. With existing conditions to-day the farmer may get all the eggs from a hen in two years while it formerly took five years. The most experienced managers of chicken farms so feed and condition their poultry that the hens begin laying during the early fall, just at the time that eggs will bring the highest price, and at the end of the second winter they are fattened and sold.

THE STEEL CITY.

Pittsburg, an Important City—Composition of Steel—Methods of Treating the Metal.

PITTSBURG, the city of steel, so called from its iron and steel manufactures, is the second city in the State of Pennsylvania, and situated in Allegheny County, at the junction of the Monongahela and Allegheny rivers. It is the leading city in the United States in iron, steel, copper, brass and glass manufactures. It is an important railroad point, headquarters of a river trade, and exports coal, coke, petroleum, etc.



AN OPEN HEARTH FURNACE USED IN MAKING INGOTS OF STEEL.

The illustration shows a large bucket filled with molten metal being poured into the furnace for reheating or fusing.

Steel has been known from early times, but its origin is not known. It has been in use in India for a long time, and is still manufactured in that country by methods similar to those in use long ago. Steel is a form of iron, not occurring in nature, but manufactured, in which the amount of carbon is intermediate between that in wrought and that in cast iron, and this carbon does not exist in the steel in the form of graphite.

Since steel is intermediate between wrought and cast iron in the amount of carbon which it contains, it may be made either by carburizing the former or decarburizing the latter. Carburization is one of the oldest methods. Though differing in details, in the essentials it is practically the same process by which Indian wootz is manufactured. By this method known in 1722 blister steel is obtained, and this is further worked up into spring, shear and double-shear steel by one or more processes of fagoting, welding and hammering or rolling, the object of this being to give the metal greater homogeneity. A great addition to the value of this process was the invention of Huntsman in 1740, of cast-steel, the product of fusion in crucibles, under suitable manipulation, of blister steel, which process is still in use as first arranged almost without change.

By this method when iron of a sufficiently high grade is used, the finest quality of steel is produced, and it is only steel manufactured in this way which can be used for the best tools, weapons and cutting instruments of all kinds.

The methods of producing steel by the decarburization of pig-iron are numerous and varied. The process known as the "Siemens," the "Martin," and the "Siemans-Martin" are most extensively employed. The steel made by any of these processes is generally called "open-hearth steel," the pig-iron being decarburized in the openhearth regenerative furnace. The most important process is the "Bessemer," invented by Sir Henry Bessemer about 1856, which consists of blowing air through molten pig-iron in a "converter," or vessel lined with a refractory material.



THE OSTRICH IN AMERICA.

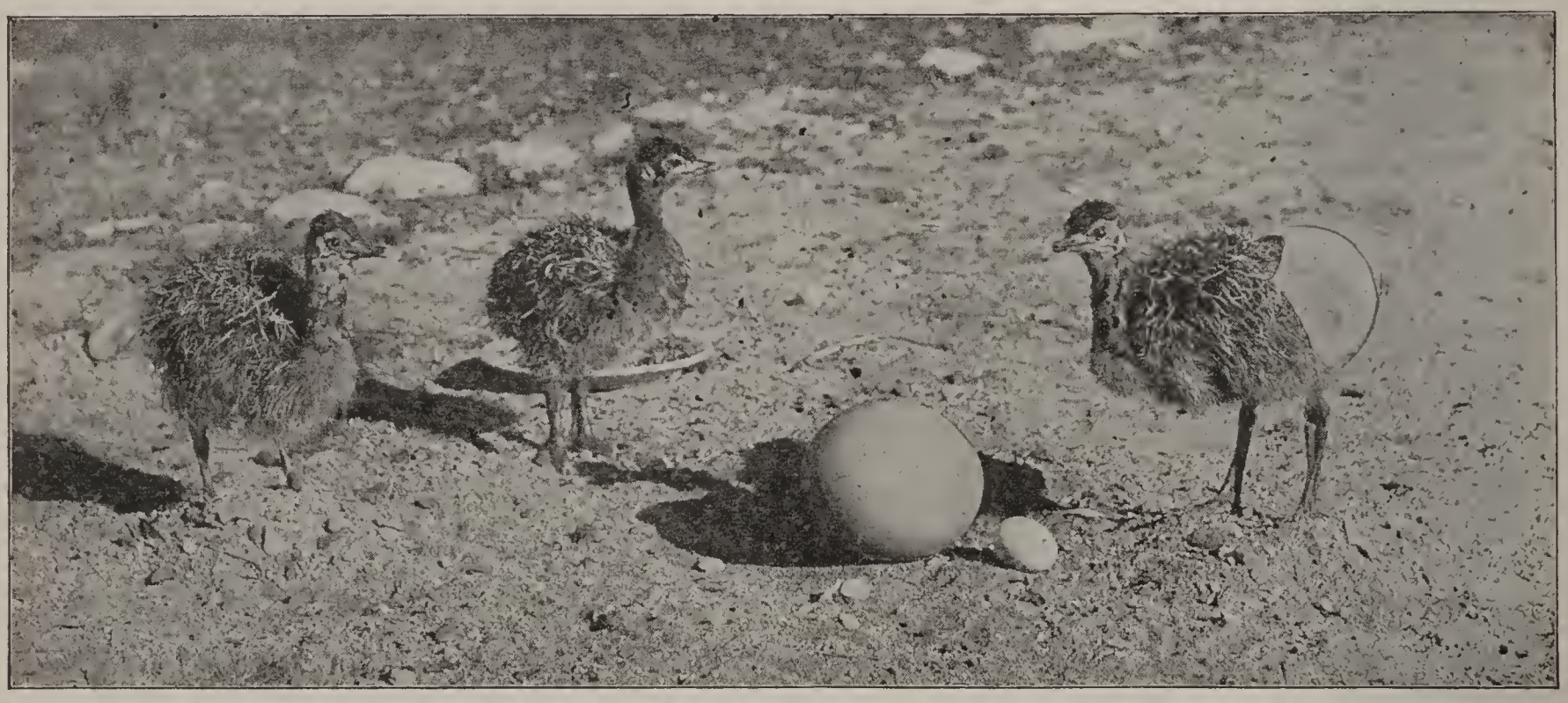
They are Raised in California—Three Farms Make a Profit Out of Them—May Be Hitched Like Horses—What Is Done with Chickens—Weight of Grown Bird.

VERY little is known in America about the ostrich, although there are, in this country, three farms on which these birds are raised. Many opinions which have been cherished from childhood about the ostrich are mere fabrications. There is no truth in the synonym frequently used: "Like an ostrich which thinks itself safe because its head is buried in the sand."

The three farms in this country are a source of much profit to the owners and also a great curiosity to visitors. The largest of these farms is located near Pasadena, a few miles from Los Angeles. This is the only farm on which the birds have been imported directly from Africa. The farm was stocked in 1886 with forty-two birds, which were transported from their native land in a ship chartered especially for the occasion. A great many of the birds died en route. This, together with the fact that most of the birds have just started to lay, accounts for the comparatively small output of the farm.

The best feathered birds are usually paired off for breeding purposes and penned in separate corrals, five of which cover an acre. During the laying season these birds are vicious, and the attendants never dare to enter the corrals. Ostriches can strike a powerful downward blow with their feet and have been known to have permanently crippled horses.

After the ostrich hen is three or four years old and when the rainy season is over she begins to lay in a sand hole three



"JUST OUT," NEW BORN OSTRICH CHICKS.

Hatched in the sand by the heat of the sun's rays. Our largest ostrich farm is near Pasadena, Cala.

feet in diameter and one foot deep. To protect the eggs from the sun's heat she covers them with sand, which perhaps has given rise to the sand theory. The male birds do most of the work. They sit on the eggs from 5 o'clock in the afternoon until 9 o'clock in the morning, when they are relieved by the females.

The chicks are taken from the parents as soon as hatched. In this way two sittings a year are obtained,—a system more profitable than that of using an incubator. A pair of birds in their prime raise on an average of ten chicks per year. In some instances thirty-two have been taken from one pair. Ostriches over five months old, except those breeding, run in troops during the day and are corraled during the night to protect them from dogs and coyotes. The full-grown bird weighs 250 pounds, measures over seven feet in height and lives about twenty-seven years.

LARGEST LIZARD KNOWN.

THE remains of what was once the largest lizard known have been found in western Colorado by Curator E. Riggs, of the Field Columbian Museum of Chicago. The thigh bone of a dinosaur which measures 6 feet 10 inches and weighs 500 pounds. It is thought that a lizard with such a thigh bone must have been over 80 feet long and 25 feet in height. This animal lived thousands of years ago, and lived on grass and tree ferns, a true vegetarian. The partial remains of several varieties of the snake family have been recently discovered in the Rocky Mountain region, showing that the climate of this section has very materially changed. For the sustenance of these immense animals it would require thick and perpetual growth now confined to the Tropics. The part of the United States now forming the Rocky Mountain system, then must have been an immense valley filled in with great lakes and immense growths of vegetation. The upheaval resulting in the formation of the Rocky Mountain system has brought within human reach the remains recently found, from the measurements of which can be constructed models, showing size, shape and general appearance of the being itself.



LIZARD LARGER THAN A HOUSE.
This lizard was larger than a house. It lived on grass, trees and ferns.

APPIAN WAY.

First Roman Road Constructed as a Public Work—Bordered by Many Tombs and Ruins—Pavement in Good Condition.

THE Appian way, most famous of Ancient Roman highways, extended from Rome to Brindisi, and was probably the first great Roman road undertaken as a public work. In 312 B. C. it was begun by Appius Claudius Caecus, the censor, and carried to Capua. It was next extended to Beneventum, and probably did not reach Brindisi until 244 B. C., when a Roman colony was inaugurated there. At the present time the Appian way, after it leaves Rome, forms one of the most notable memorials of antiquity in or near the Eternal City, bordered by tombs and the ruins of monumental buildings. Long stretches of the pavement remain perfect, and show that the width of the roadway proper was fifteen feet. This highway was the first of many great public highways constructed by the government of Rome immediately after the Romans were successful in their war against the Carthaginians, and had added to their territory Southern Italy. The termination of this war greatly increased the wealth of the Romans. Each free Roman was granted by the Roman Senate either a sum of money or seven jugera of land, as he elected. These newly acquired possessions consisted of public lands, valuable forests, mines, quarries and fisheries. In order to hold her new territory, however, Rome planted the Peninsula thickly with colonies, and connected them with the Capitol by these wonderful and elegantly constructed highways.



APPIAN WAY.

Commenced in 312 B. C. Leading from Rome to Brindisi. It is bordered with Tombs and monumental ruins. Here the ancient Roman Emperors for centuries drove in their chariots decorated in costly splendor.

THE WONDERFUL ERMACK.

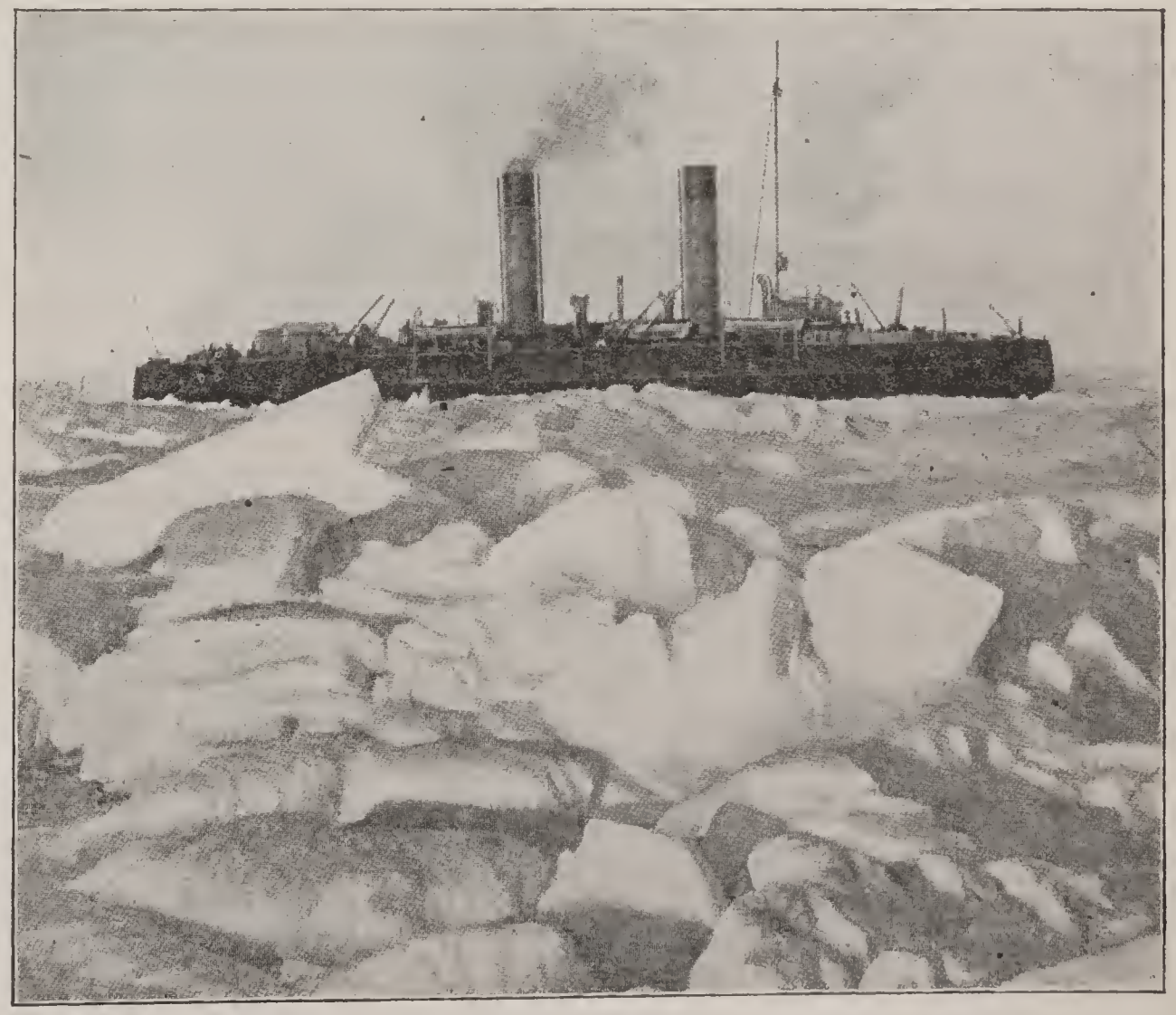
A Russian Vessel of Marvelous Strength—It Is Hoped She Will Yet Force Her Way to the North Pole—Manner of Construction and Method of Opening Arctic Wastes—First Suggested by American Ice Breakers.

FOR the last twenty years inventors have been endeavoring to construct steamships to navigate the Arctic waters. Few if any of these have met with success. The Russians, who have taken a most active part in this work now have a vessel which bids fair to accomplish the feat. It is the ice-breaker "Ermack."

This unique ship was suggested by the ice crushers which ply the waters of the Straits of Mackinac. She is built for neither cargo nor passengers. Instead of having a double bottom, as most vessels are equipped with, the Ermack has a double frame throughout. Steel plates, a quarter of an inch in thickness, form the epidermis, and they extend from the keel to the level of the deck, forty feet above. Within this frame is another. Staunch braces of steel connect the two walls while the space between them is divided into water-tight compartments, varying from ten to three feet in diameter, and extending completely around the vessel.

Two Ships in One.

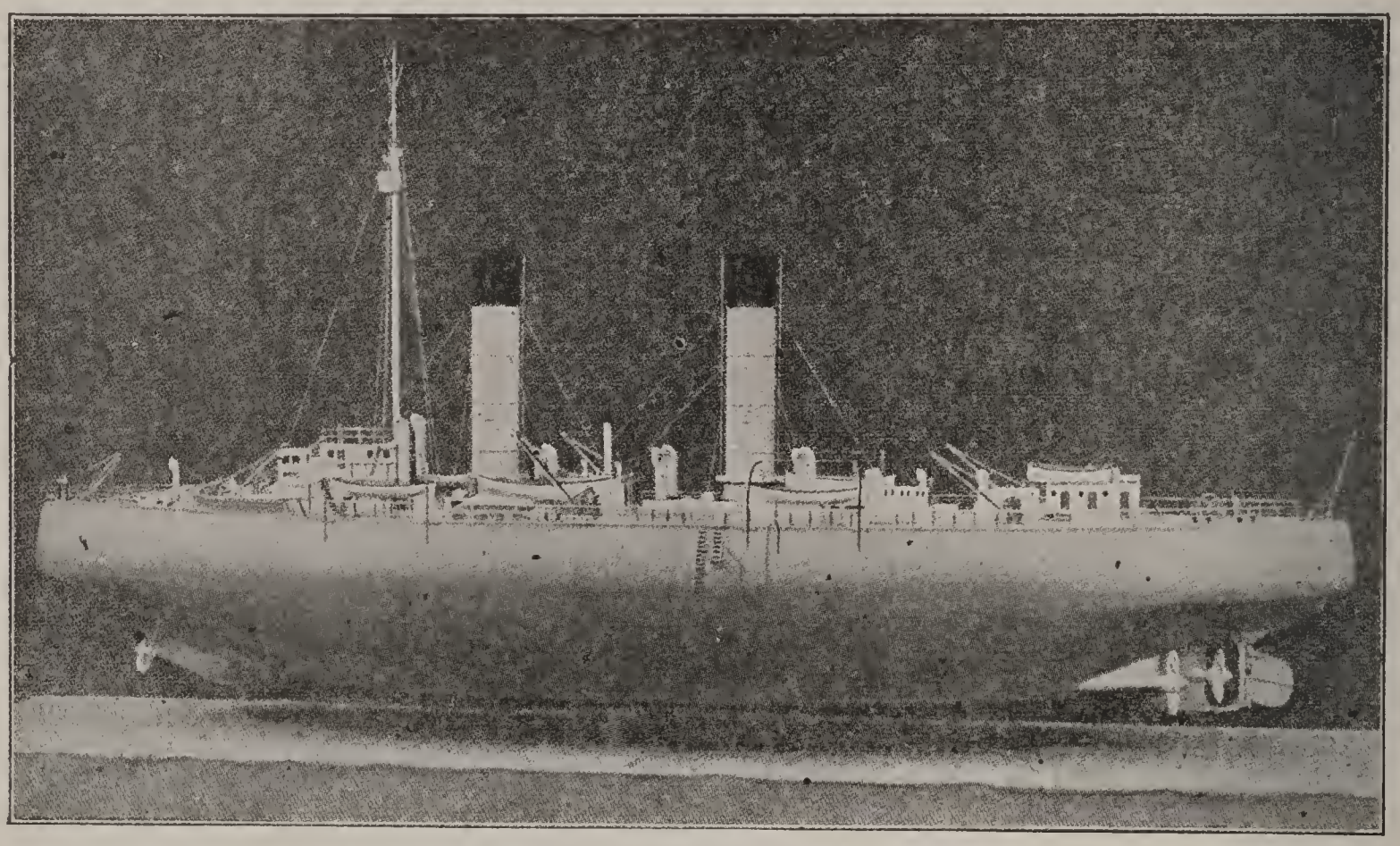
The "Ermack" is virtually two ships in one. Her deck is double, two sets of sky-



THE ERMACK AT WORK IN ARCTIC ICE.

lights are provided, and a wooden partition incloses the cabin, regardless of the fact that the apartment itself is constructed of thick steel plates. The wooden coat is provided more with a view to warmth than durability. Heat is furnished from the ship's boilers through steam pipes which run between the inner walls. The temperature of the "Ermack's" cabin is always comfortable, as the outer air chamber prevents the heat from escaping. The ship is divided into forty-eight water-tight bulkheads, most of which extend to the deck level. After she was built these compartments were filled with water, but the vessel retained her buoyancy as gracefully as before. The provisions for strength and durability take up much room. Of the remaining space the propelling machinery, located amidships, takes up the greater amount.

Power is furnished by four propellers—three aft and one at the bow. They may be operated independently in case of accident, as they are connected with separate engines. The total horse-power of the ship is 10,000—2,500 for each propeller. The forward propeller was adopted from the ice-breakers used on the Great Lakes. The object of this screw is to suck the water from beneath the ice in order to make the resistance less. In loose ice it may be reversed, which forces small blocks of ice from the vessel's course. Cabins, scientific laboratories and quarters for officers and crew occupy the remaining space. Her bunkers carry, when filled, 3,000 tons of coal. Altogether the vessel cannot be called large, as her total displacement is but 8,000 tons.



A MODEL OF THE ERMACK.

The most powerful ice crusher in the world. She may yet reach the North Pole.

Peculiar in Appearance.

Her external appearance is as remarkable as her interior arrangement. Sharp lines mark her stern and sides. Her sides, instead of meeting the water at an angle of 45 degrees, project above it, giv-

ng her the appearance of being top-heavy. She appears to lie upon the surface, while as a matter of fact she has a draught of twenty-five feet. She is 305 feet long, and has a beam of seventy-one feet, which gives her a very blunt appearance. Her speed is anything but fast. In clear water the "Ermack" can make but fifteen knots an hour, the pace of a heavy battleship. She has the appearance of a stout warship, and if put to the test could render a good account of herself, owing to her strength.

The method of attack pursued by this vessel will seem remarkable to the uninformed. It does not charge the ice barrier directly. Instead it pushes its prow up the edge of the berg. With the engines working to their utmost, the forward part of the vessel ascends the barrier until a pressure of 900 tons is brought to bear upon the ice. If the resistance is still too great, an apparatus for adding 200 more tons of pressure is provided. Great pumps are put to work in the hold of the vessel which force thousands of gallons of water to the compartments forward until the pressure directly over the ice reaches 1,100 tons. These same pumps can force the water to different parts of the ship in case a quick move is desired to avoid accident. At times the vessel climbs the edge of the ice until more than ten feet of that part usually below the water-line is visible. Then, unless the ice be solid, the formation gives away. In this manner the craft proceeds and fairly crunches its way through ice fields that would prove absolutely impossible for ordinary vessels to penetrate. This idea of crushing the ice is not entirely new, as it is in vogue on the River Volga, the North Sea and the Great Lakes.

Mate of the Locomotive.

The birthplace of this wonder is also remarkable for the home of the first locomotive—Newcastle-upon-Tyne. She was wrought out at the yards of Sir G. W. Armstrong. When she braced the waves on her initial voyage she was named "Ermack" after the Cossack warrior who conquered Siberia. The primary object of the construction of the "Ermack" was not to aid the cause of Arctic exploration, but to open up the vast region in that vicinity to civilization and Russian capital. Russia has the longest coastline of any country in the world, but for many months in the year its ports are impassable owing to the ice. The government recognized the great loss incurred by the ice, and set about remedying the evil. The "Ermack" was the result. She was completed in February, 1900. Kronstadt was named as the destination of her first voyage. It seemed ridiculous to make the trial, but as the vessel slowly poked its nose into the harbor of that city the entire population stood on the shore and welcomed its arrival. Thus did the "Ermack" practically display its ability. Thirty ice-bound merchant vessels were freed on this trip and escorted to the harbor, one in a sinking condition.

Her next trip was in the ice fields farther north. Owing to the great depth of the ice her forward propeller was removed, as it proved a hindrance. The trip was regarded, however, as entirely successful, and a number of scientists returned from the cruise with much valuable information.

POMPEII.

An Ancient City of Beautiful Dwellings—Lack of Magnificent Civic Buildings—Some of Its Buildings.

THE ancient city of Pompeii was situated on the Bay of Naples, Italy, thirteen miles southeast of Naples, and nearly at the foot of Mount Vesuvius. It was a flourishing provincial town where many Romans lived. In 63 A. D. an earthquake severely injured the town, and in 79 an eruption of Vesuvius completely destroyed it. The site was discovered in 1748, and excavations made.

The buildings of Pompeii were modest, and its private dwellings handsome. Many antique sculptures and utensils have been excavated from the ruins. Among some of the more important and imposing structures found are the great theater, of the time of Augustus, semicircular in plan, with a diameter of 322 feet. The cavea has two precinctions: Below the lower one there are four tiers or seats of honor; the upper one has communication by passages and stairs with the triangular forum, and above it there are raised tiers of seats for



METHODS USED IN BUILDING THE PYRAMIDS, ANCIENT EGYPT.

Upon whose work 100,000 men, women and children were engaged for years.

women and a platform for working the awnings.

The Temple of Isis is a small tetrastyle prostyle structure raised on a basement in a peristyle court upon which open the lodgings of the priests. The house of

room and dining room. The house of Meleager is noted for its paintings and decorations. The house of Pansa is one of the largest and most elaborate dwellings of Pompeii. It measures 120 by 300 feet. The house of Sallust is a large



UNCOVERED RUINS OF THE ANCIENT CITY OF POMPEII.

Which was overwhelmed by the eruption of Mt. Vesuvius, 79 A. D. Archaeologists are still working in the ruins.

Castor and Pollux is a double house with a large peristyle court common to the two parts. The exterior of the house is finished with stucco decoration in panels and arabesques. The house of Marcus Lucretius is a double house of three stories. It has a beautiful reception

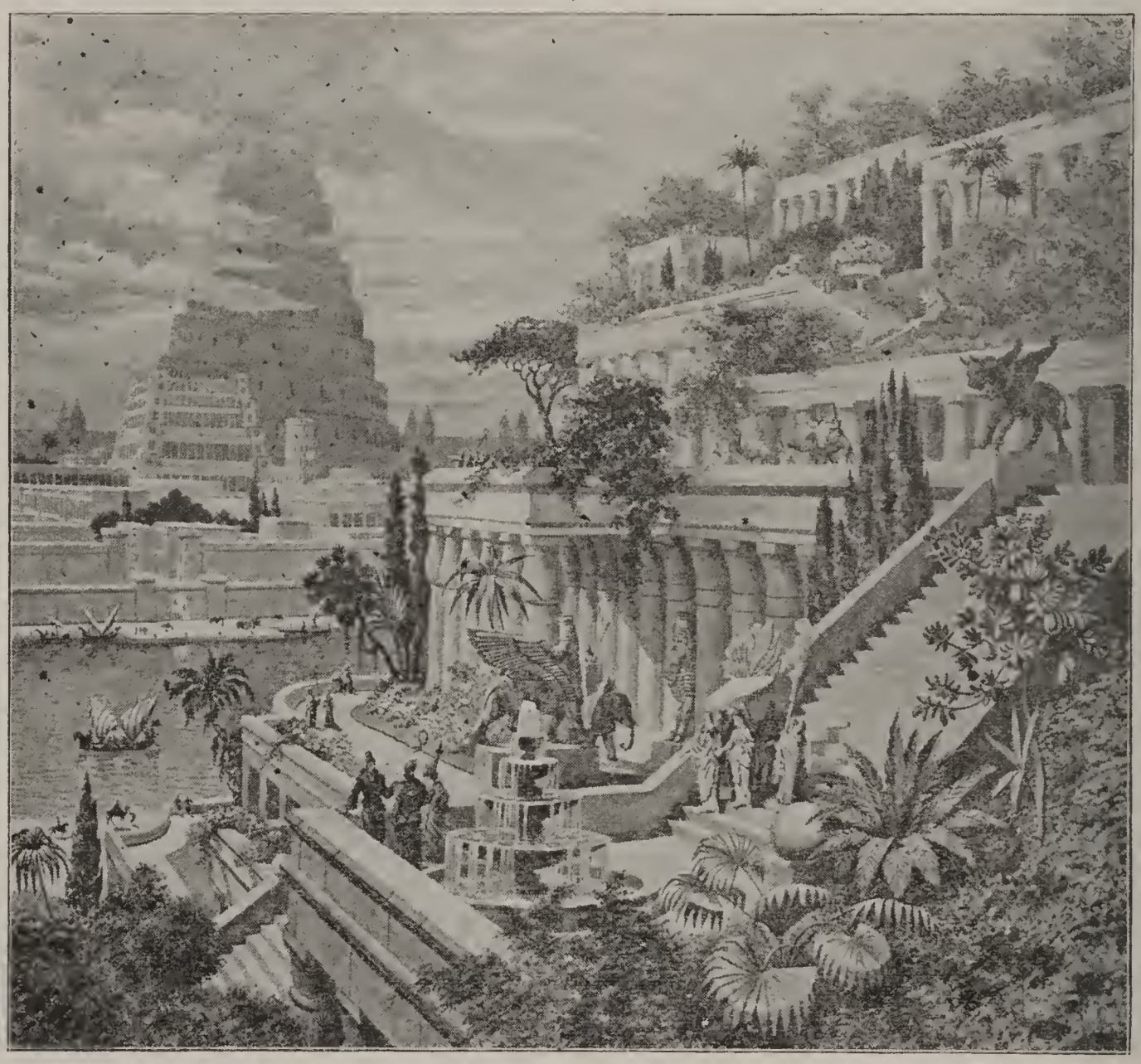
and richly decorated mansion, similar in arrangement to the house of Pansa. The house of Faun is considered to be the best in style of the ancient city. The wall paintings are replaced by Mosaics. The famous Dancing Faun and the mosaic of the Battle of Issus,

in the Naples Museum, came from this house.

The ruins of Pompeii have furnished us the best information we have on the material civilization of Rome. Excavations were commenced between 1808 and 1815, and have been continued since that time.

Five hundred years prior to the destruction of Pompeii by the ashes and lava from Vesuvius, and probably at a time when Pompeii was the Metropolis of Southern Europe, there existed in Southern Asia the flourishing city of Babylon. From here Nebuchadnezzar ruled Babylonia during the most illustrious period in the history of that country. He built canals, reservoirs, irrigating sluices, harbors on the Persian Gulf, and made Babylon the most magnificent city of Asia.

In order to gratify his queen, Amyitis, who pined for the mountains of her native Media, he built the celebrated Hanging Gardens of Babylon, which consisted of terraces built on arches raised high above the city. Earth was laid on this structure and planted with trees and shrubbery. On the highest levels were fountains and cascades which nourished the plants. Art strove to emulate Nature, and the lofty rocks and various trees of this wonderful Paradise were a pleasant change from the monotony of the Babylonian plain, and served to remind the Babylonian Queen of her husband's love, and the beauty of her native country.



ONE OF THE SEVEN WONDERS OF THE WORLD.

The Hanging Gardens of Babylon, near the Tower of Babel. Time has destroyed this wonder. It is estimated they cost $10,000,000 to build.

MODERN FIRE FIGHTING.

New York Training School—How Drilled—Salaries Paid—Modern Appliances—Private Companies, How Organized and Equipped.

THE largest fire the world has ever known occurred in Chicago, October 9, 1871. The loss was 200 lives and $290,000,000 of property. Since the days of volunteer fire companies, when young men were ready to exchange evening dress for the helmet and rubber coat of the fire fighter, there have been many developments in the methods and means of combating fires. The old hand-pump engine has been relegated to history, and in its stead the steam engine belches forth its watery protest to the flames. It is not improbable that even this complicated monster of fire and water may soon disappear.

In the place of the volunteer now stands the professional, who undergoes a thorough training before he is admitted to service. The Firemen's Training School, of New York, from which 40,000 men have been graduated in the past sixteen years, occupies handsome quarters erected and equipped at a cost of more than half a million dollars. There men are drilled in the mysteries of the guild. First comes instruction in handling the scaling ladder, and adroitness in passing from window-sill to window-sill, and knowledge of this is regarded as highly essential and valuable in the service.

Then the men are taught to handle the life line. A light rope is shot to the roof, where it is seized and a heavy line drawn up by means of it and made fast. Each man is provided with a life belt, in the front of which is a "snap." A few turns of the line about this attachment relieves the fireman of all but about five pounds of pressure, so that an easy descent is possible. When the man is bringing down a helpless body or additional weight, two additional turns are necessary.

Last Stage of Drill.

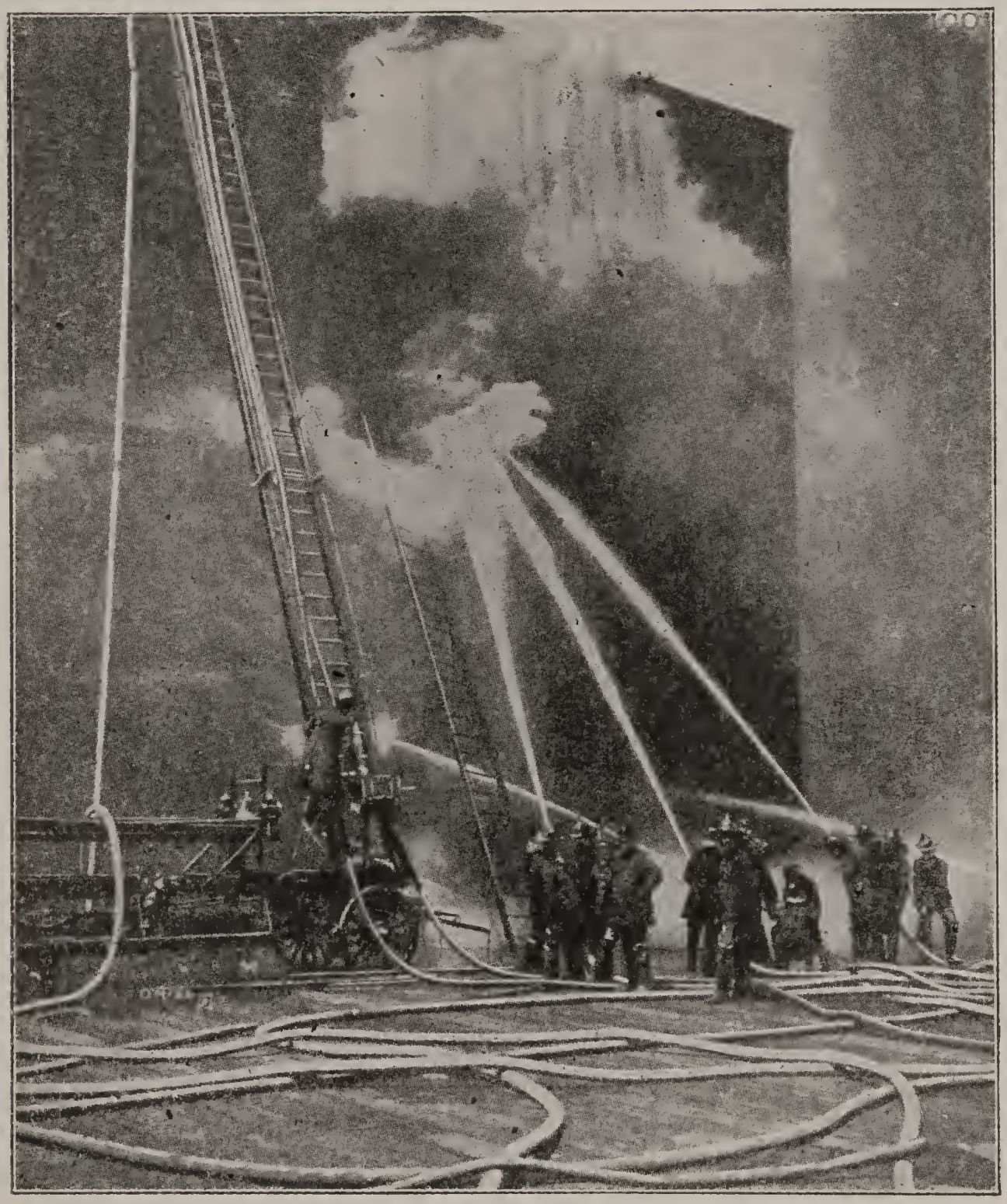
The final step is taken when the men are thoroughly drilled in the manipulation of the life net. A tinge of realism is given this practice by precipitating bags of sand, weighing from 75 to 100 pounds, into the net from an elevation which would correspond to a three or four-story window. When the men have become sufficiently proficient, they are enrolled in the service and the serious work of the fireman begins.

The first three years the salary is $1,000 per year, and thereafter $1,400. The annual compensation of the officers is:

Chief	$5,000
Department Chief	4,300
Chief of Battalion	3,300
Captain	2,160
Lieutenant	1,800
Engineer	1,600

After twenty years of service, retire-

ment on half pay may be allowed; and in case of death while on duty, $1,000 and a pension of $25 per month goes to the nearest kin. As a class the firemen are superior physically to the policemen. In addition to regular municipal departments many mills and factories are equipped with hose, ladders, hydrants at convenient intervals, and other modern apparatus. Their employés are organized into hose and ladder companies, engineers, etc. Such private organizations are suggested, encouraged and required by some insurance companies and add to the security of property. Some insurance concerns supply a pamphlet of tactics for the instruction of private organizations.



MODERN FIREMEN FIGHTING A BLAZE IN A GRAIN ELEVATOR.

Note the huge streams of water.

There are two simple contrivances, the product of modern ingenuity—simple things are the most difficult to create—which, if used promptly, afford almost absolute immunity from danger, either to life or to property.

The Fire Extinguisher.

The first is a fire extinguisher. It consists of a small bottle of acid sealed with mica and containing a rubber-covered lead ball. This bottle is within a larger one, holding, in addition, four gallons of water in which soda is held in solution. The whole apparatus is enclosed in a metal case and fitted with a hose. At alarm it is inverted, the ball breaks through the mica, and the released acid, coming into contact with the soda and water, generates gas, which discharges a stream of fluid about fifty feet.

At a test made in New York, one of these machines extinguished in 59 seconds a fire in a pile of pine boards and barrels which had been saturated with kerosene and allowed to burn until some of the timber was charred. Such a device would

have prevented the New York Windsor Hotel fire, and the loss of forty-six lives. The second contrivance is a simple strip of canvas which is bound on the edges with rope and can be rolled up and fastened at the window-sill. When fire breaks out these rolls are cast out the window, the sympathetic crowd seizes the lower end, makes it fast across the street, and in the improvised chute the building's occupants slide to safety.

Until recently, many students of the fire problem have maintained that our modern sky-scrapers should be abbreviated and brought within range of the engine, which cannot force a stream higher than nine or ten stories, but a New York engineer maintains that the fault lies with present methods of fire-fighting, and not with the height of the buildings. If properly equipped, he says, the sky-scraper could be made a protection, not only to itself, but also to surrounding structures. A row of sky scrapers would have prevented the spread of the flames which devoured Chicago three decades ago. New York has finer natural facilities for an effective fire system than any city in the world. Surrounded on three sides by water—salt water at that—and all parts of the city easily accessible, an almost perfect system might be established.

"Control," the Watchword.

"Control" is the watchword of the fire fighters of to-day. To confine the flames to the point of origin rather than merely to extinguish them is recognized to be necessary. Direct attack of the origin of the fire would frequently be futile, and not only would it be impossible to extinguish the flames at that point, but attention there would allow them to spread.

The fire losses paid by insurance companies, each having over $1,000,000 assets during the year of 1898 amounted to $56,000,000. The largest and finest fire department in the world is owned by the city of Chicago. Since 1871 its equipment and maintenance has cost the city $50,000,000. The city maintains ninety steam fire engines, all of which can be used at one fire. Chief Swenie, of the Chicago department, is ranked as the "first fire fighter" in the world. He has been in the Chicago department fifty-one years.



SPECULATIVE HAND SIGNS.

How Brokers Buy and Sell Grain and Stocks—Expressive Use of the Fingers and Hands—Code of Honor that Governs all Traders.

MILLIONS of dollars change hands daily in Wall Street and the other great money markets of the world without the scratch of a pen. The trading is carried on with signs made by the hands and fingers. It is generally recognized that men must be scrupulously honest in these dealings, more honest, in fact, than in almost any other business. The reputations and the opportunity to be disgraced are so great that many rules are in use which would seem curious anywhere but on the floor of the exchange. Visitors to these exchanges during a busy session imagine that the brokers and every one on the floor are crazy, but through all that excitement the greatest order and system prevail.

The noise at these sessions is so great that men are unable to hear one another talk even when speaking directly into the ear. Megaphones cannot be used, as this would make matters worse. In order to make sales with a customer standing a few feet away the broker has a code of signals or signs which he makes with his fingers and hands like a deaf and dumb person. In this way millions of dollars worth of stock are bought and sold daily throughout the world.

How it is Done.

The hand vocabulary enables a man to bid or make offers on a stock and announce the number of shares and an exact fractional price more quickly than he could speak. A single finger of either hand held horizontally signifies ten shares of stock or 1,000 bushels of wheat. Two fingers together mean twenty shares or 2,000 bushels of wheat, and so on. Fifty shares is signified by an "O," made by the thumb and first finger. One hundred shares or 100,000 bushels of wheat



THE SIGN LANGUAGE.

Used by members of a Board of Trade in buying and selling grain and shares of stock.

are signified by a closed hand. When a broker wishes to buy wheat or stocks he lets his fellow brokers know by extending his hand partially open, and drawing it slowly to him. When anxious to sell he pushes his open hand from him. The names of stocks are not told by signs, but the brokers gather about blackboards which bear the names of the stocks being sold.

The rules of the exchange governing all such transactions are very rigid, yet it is surprising the large number of disputes arising every day. A committee of a half dozen or more men are constantly patrolling the floor to enforce the rules. A man with authority to decide disputes also sits on a seat overlooking the floor, but these precautions are rarely needed. A thousand disputes which it would seem must inevitably end in a free-for-all fight arise each day and quickly subside.

It sometimes happens that two men will misunderstand each other in quoting a price, and that after the sale is made each will have a different quotation in his mind. The disposition of these cases is curious. The disputants immediately go before the presiding officer and state the trouble. The friends of both parties immediately crowd around the judge. The officer in charge then calls for a vote of hands on the dispute, and the majority rules.



DULUTH BOARD OF TRADE AND THE TRADERS IN THE WHEAT PIT.

RUBBER MANUFACTURE.

Adhesive Nature and Process of Treatment—Manufactured Articles Made by Compression—How Rubber is Vulcanized.

IT has been but two centuries since rubber was known only as a curiosity; now it is used by all in everyday life, and has added greatly to the possibilities of the industrial arts.

The process by which crude rubber is treated to bring it to useable shape are simple and consist mostly of kneading by steam rollers. The first operation is the softening by throwing it into hot water tanks. Here it stays some hours and is then removed and cut into chunks and thrown into "washers," which are heavy machines with steel corrugated rollers.

This serves to crush and mangle the rubber as it passes through and also removes impurities by means of small streams of water playing down upon the washer. Sometimes the rubber contains a curious impurity in the shape of big brown rubber bugs, which are able to live in the recesses of the rubber without food and with little air.

Rubber Is Adhesive.

So adhesive is the nature of rubber that in a little while the washer has transformed the chunks into a continuous sticky mass. These sheets are allowed to dry and then are crushed again between heavier rolls. Next the rubber is run through the mixers, which are hollow steel rolls fitted on the inside with steam and water pipes to heat or cool in the operation of mixing. Here the rubber rolls through and through and adheres to one of the rolls like a blanket. This is cut off from time to time by the operator, who cuts with one hand, making the incision diagonal from side to side and rolls it up in a big bundle with the other hand and throws it back again for another kneading. A great amount of power is needed for this mixing, owing to the sticky property of the raw rubber. After the proper amount of kneading a compound is thrown in with the rubber that colors it the proper tint and gives it the particular qualities it needs for its destined work.

After the compounding the rubber material is run through calenders, or four polished steel rolls one above the other. which gives it the required thickness. The calenders are also used for crushing the rubber into cotton duck for making rubber cloth, etc.

All manufactured rubber articles are made by compression, not by melting, and pouring into molds, as some think. The great process of vulcanizing rubber, discovered by Charles Goodyear, may be described as a method to effect a chemical change in the rubber whereby the sticky and elastic qualities are removed by the application of heat (usually by steam) and



RUBBER TREE IN U. S. BARRACKS, KEY WEST, FLORIDA, OVER 100 YEARS OLD.

giving durability and other wearing qualities. Hydraulic presses are used with steam connections suitable for the several kinds of rubber goods to be made, and pressure of about 2,000 pounds generally being exerted under heat to vulcanize.

Vulcanizing Rubber.

In vulcanizing rubber belts a stretcher is used to remove the stretch in the belts when they are being vulcanized. This consists of a heavy set of clamps with two hydraulic rams at 2,000 pounds pressure per square inch. In the manufacture of rubber belting the cotton duck which has had rubber pressed into it through the calenders, is laid out on long tables and cut into strips of the width the belt is to be. The strips are laid one over the other to the required thickness, and a thin sheet of pure rubber wrapped about the several ply. The belt is then rolled up and finished by vulcanizing in a steam press.

Rubber hose is first slipped in rubber tube form over an iron mandril. Then it is wrapped with duck stripping its desired thickness, and outside this is rolled a thin sheet of rubber. This is covered with

strips and sent to the vulcanizer. The vulcanizer for this work consists of a wrought iron pipe which can be closed at the ends and admits of steam for heating to the proper temperature. Compressed air is blown between the pipe and hose to remove the latter when the process is completed. Cotton covered rubber hose, such as is used by firemen, is made by drawing the rubber tube with the woven hose and then the whole is blown full of steam.

DARING SEAL HUNTERS.

The Seal Has Been a Mischief Maker—Outlaws of the Sea Who Defy England and America—Laws Against Pelagic Hunters—Hunting the Sleepers and Defying Death.

SEAL has been a word synonymous with trouble to the United States and Great Britain since 1886, and to the former for even a longer period. The seal has been an unconscious mischief maker. When the United States paid $7,200,000 to Russia for the territory of Alaska in 1867 it was with no conception of the trouble that land held for the future. The first act of the government was to place the new district under control of the treasury department, and to enact laws prohibiting the slaughter of mink, martin or fur seal.

The Pribilof Islands of St. Paul and St. George, the breeding place of the seal, were eagerly sought after as the happy hunting grounds of the sealers, and to the Alaska Commission Company this part of the new territory was leased for a consideration of $60,000 per annum and a royalty of $2 for every seal taken by the lessees. The company was limited to 100,000 seals per year. This was regarded as an equitable agreement, and doubtless the treasury officials thought themselves very clever to have arranged matters so comfortably, but here a new and unknown element arose.

The Pacific slope began to attract the ambitious youth and others of the east, and as the region west of the Rockies began to teem with new activity and life, complications entered into the seal question. Pelagic sealing (sealing in the deep ocean) began, and soon the herds were so diminished that the Treasury officialdom was greatly alarmed. No drastic measures were employed, however, until 1886, when the United States revenue cutter Corwin was dispatched to arrest all violators of the law.

Three British schooners were seized, their skins confiscated, the boats condemned and the owners fined. Immediately arose a great uproar from Great Britain. It was demanded that the queen's subjects be instantly released. By order of the President this was done. But the Treasury department sent the cutter Rush in the following year, and a similar procedure followed.

The Bill of 1889.

The advent of 1889 brought with it a

bill for the better protection of the seal, and it was proposed to arbitrate the differences between the British and their American cousins. The bill passed Congress and the arbitration scheme was practically adopted. By this time, however, the season of 1891 was approaching. It was impossible to complete arrangements for arbitration and yet it was imperative that measures be taken to suppress the pelagic poachers before they resumed operations. Accordingly a modus vivendi was negotiated in which both Great Britain and the United States agreed to seize all violators of the existing law.



A SPERM WHALE.

Stranded by the tide and unable to float itself, subsequently killed and cut up for its oil and bone.

The High Joint Commission was appointed and met in Paris, February 23, 1893. It consisted of two arbiters from the United States, two from Canada, one from France, one each from Italy and Norway and Sweden. The case of the United States, presented by its counsel, filled six large printed volumes, and that of Great Britain filled eight equally large volumes. After the necessarily long deliberations of the tribunal, it handed down decisions which were rather favorable—all things considered—to the United States. Furthermore, it formulated a code of regulations which were to continue in force until either of the parties violated their terms. These regulations prohibited the killing (except by Indians) of seal within sixty miles of the Pribilof Islands at any time, and nowhere in the North Pacific from May 1st to July 31st. This close season of three months gives the seals an opportunity for safe passage to the Pribilof Islands from their winter quarters across the ocean. Besides this, the use of fire arms (except shot guns), nets or explosives were forbidden.

Other Provisions.

Pelagic sealing could be prosecuted outside the sixty-mile limit from August 1 to May 1. These regulations still govern sealing operations. Such rules, even, have not succeeded in protecting the herds. Nothing but a law which will absolutely prohibit pelagic sealing for a period of years, and thus allow the herds to restore themselves, will prevent their utter extinction. The Anglo-American Joint Commission which considers all differences between the United States and Canada, weighed this question in 1897, but although the United States strongly urged the adoption of such a law, the Canadians absolutely refused to consent.

In the same year Congress passed a bill prohibiting sealing except by the North American Commercial Company on the Pribilof Islands, and demanded papers bearing a complete record of every skin applying for entrance at our ports. This was a blow to the Canadian interests, and was designed to force them to agree to the temporary suppression of pelagic sealing.

The pelagic or sea hunters carry on their operations from schooners which, during the stormy season, sail from our shores direct to Yokohama. This circumnavigates the disturbances and thence

they bear toward the sealing grounds. The schooner sails swiftly along and suddenly the shrill cry, "Sleepers" comes from the watch. The boat is lowered and provided with compass, water and provisions for five days, a shot gun and a hundred shells,—then the hunters start.

Fifty yards away the seal is plainly discernible. He is asleep on his back with his flippers across his belly. The oars are taken in and stealthily the steersman shoves the boat toward the quarry. All hands are silent as the tomb, for although his eyesight is poor, the seal has a keen scent and acute hearing. He is approached from the leeward. Silently the boat diminishes the distance until, at fifteen yards, the gun flashes and the prize is won.

The boats are often out several days together, and in rough weather it is no mean achievement to land the seal with both boat and quarry tossing violently. At the Pribilof Islands the government has built fences to confine the bulls during the breeding season, and, where the ground is flat and smooth, boulders and rocks have been provided to protect the pups while the bulls engage in their perennial battles. The catch for the past few years has been:

Land Catch.		Pelagic Catch.	
1896	28,964	1894	61,838
1897	20,890	1895	56,291
1898	18,032	1896	43,917
1899	18,050	1897	24,322
		1898	21,200
		1899	19,512

ELECTRIC STREET RAILWAYS.

Popularity of Electricity as a Power—Guards Against Accidents—Franchises, Duration and Compensation—Detroit's Great Fight.

ELECTRICITY as a means of propulsion for street railways has grown in such favor that cars so operated in the United States are now in the majority. Of the 1,121 street railways in operation in 1899, 966 were electric and the remaining 155 as follows: horse, 103; steam, 31; cable, 21. It is expected that cable roads will disappear entirely, likewise all but the short and unimportant horse lines.

About one-fourth of all the horse-car lines in the country are in New York state and these lines represent about one-third of the mileage and a great majority of the horses in use. The greater number of these horse lines are in the suburbs of New York City, and it is expected that these will give way to electricity.

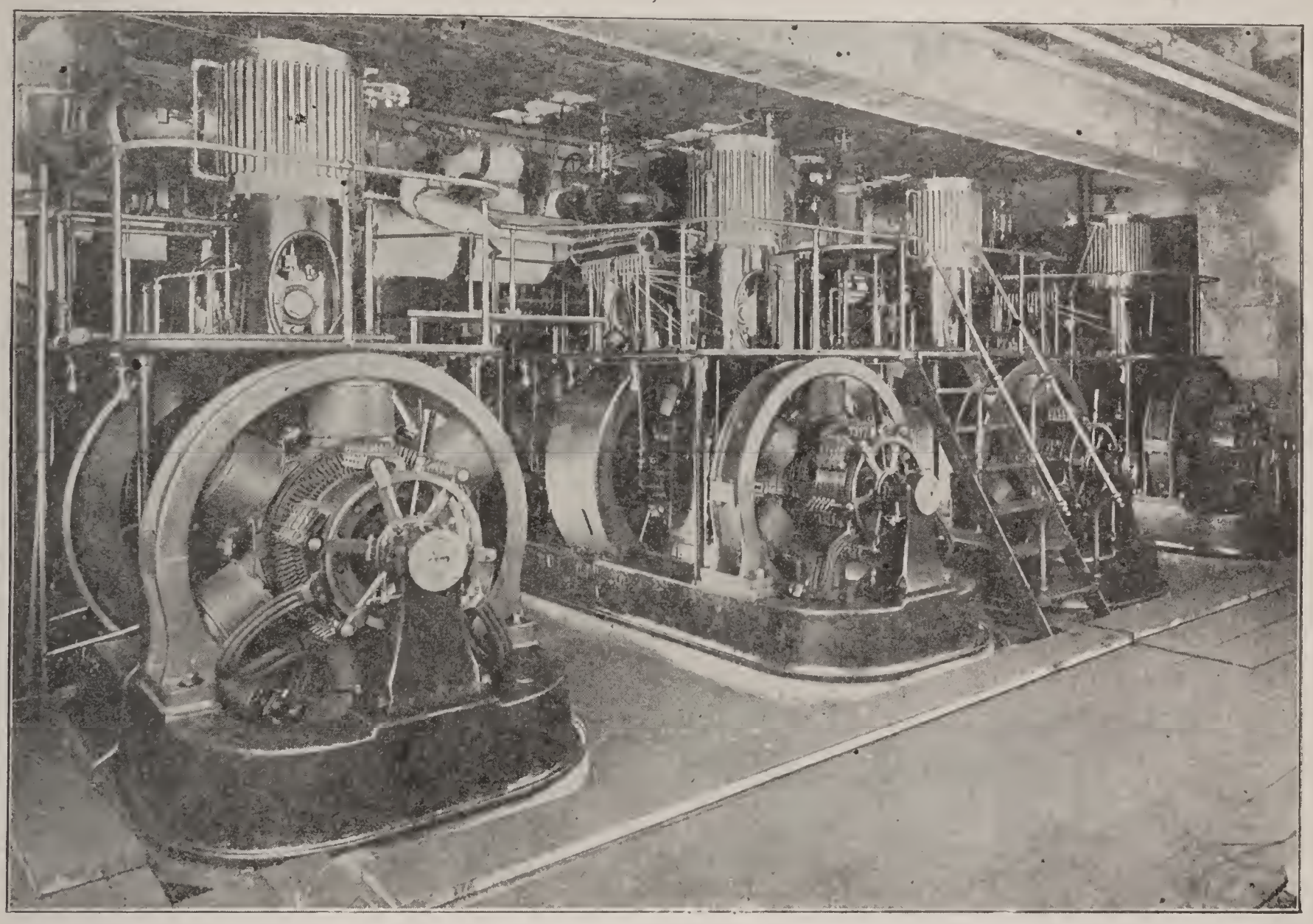
In place of steam many of the elevated roads use the third-rail electric system. The street railways of the United States are capitalized at about $1,600,000,000. In nearly all the country outside Washington and New York cities, the overhead electric trolley system has gained a strong foothold. In New York the open slot underground system has pushed rapidly to the front, and in Washington nearly all the lines are so equipped. In Europe the overhead trol-

ley system continues to be the one generally employed.

Roadbeds are Improving.

Many improvements have been made in the line of road-bed construction in the last few years. Permanence and stability have been insured by cast-welded joints and electrical welds. Some roads have tried concrete beams and blocks for the wooden ties. An attempt to bond rail joints has been made with a view to returning waste current to the power houses by the rails instead of by gas and water mains, and thus save the latter pipes from being destroyed by electrolysis or disintegration by electric current.

In 1898, in Lowell, Mass., an automatic block system for single-track electric roads was installed to aid cars in passing from an opposite direction without collision. The line was divided into blocks, each of which was connected with an automatic cut-off, so that when a car entered that block the current was cut off until it left that block. Then the current was turned on again automatically. Thus two cars could not come into the same block from opposite directions and collide.



POWER HOUSE OF AN ELECTRIC STREET RAILWAY.
Showing the powerful dynamos used to generate the electric current.

There have been many accidents on electrically operated lines. One of the worst, in 1899, was in Bridgeport, Conn., on August 6, when twenty-nine persons were killed and many more seriously injured by the fall of a car from a high trestle. The car jumped the track as it was going upon the bridge and bumped

along the ties for eighty feet, then leaving the bridge, turned upside down and crashed to the bottom. The heavy motors on the bottom of the car broke through the floor and crushed the passengers beneath. Many of the cars are equipped with power brakes operated by electricity and air, decreasing the liability of accident.

Largest Power Plant.

The largest power plant for a railway in the world is that for the Third Avenue Railroad Company, at 216th Street and 9th Avenue, New York City. It is equipped with sixteen engines of the vertical, cross-compound condensing pattern, having generators mounted on the shafting between the cylinders. Each engine has a normal horse power of 4,500, making a total of 72,000 horse power on the average, which can be developed on an emergency to 100,000 horse power. Sixty boilers of 200 pounds pressure each are stoked by machinery from boats to the furnaces, and are emptied of ashes in a similar manner. The chimneys are 200 feet above the floor of the boiler-room and consist of four stacks, which are made of brick for the first 102 feet and of riveted steel courses for 98 feet. The steel part is self-supporting, 12⅔ feet in diameter and lined with brick. The ordinary chimney draught is supplemented by eight exhaust fans. There are sixteen generators of electricity in the plant, one for each engine, and the current is led into the railway lines from five or more transformer sub-stations.

Detroit's Fight for Ownership.

In 1899 a struggle for municipal control of the street railways of Detroit attracted considerable attention. The movement was defeated by a court decision to the effect that the state constitution prohibited the use of State funds for internal improvements in Michigan, and that it was illegal for a city to construct street railways, since the legislature could not authorize a city to do what the state itself was not allowed to do.

The franchise question—the right to use the public streets for a certain period of time is agitating the cities and street railway companies of the United States. The question of compensation to the public is involved with the franchise question.

The following is a comparative table of length of street-railroad and other franchises in Chicago and the principal American cities:

	Years.
Elevated railroads in Chicago	50
Steam railroads in Chicago	perpetual
Gas companies	perpetual
Telegraph companies in Chicago	perpetual
Street railroads in New York	999
Street railroads in Boston	perpetual
Street railroads in Philadelphia	999
Street railroads in Washington	99
Street railroads in St. Louis	45 and 50
Street railroads in San Francisco	99
Street railroads in Kansas City	50
Tribune's school lease	99
Record's school lease	99
Trust newspapers' tubes in downtown streets (Medill & Co.)	50
Asked by street railways in Chicago	50

Rates of Compensation.

Comparative table of the highest rates of compensation paid to the municipalities by the street railroad companies in various cities of the United States:

	Per cent gross receipts.
New York	3
Boston	4.5
Philadelphia	nothing
St. Louis	2
Washington	4
San Francisco	5.15
Kansas City	2.5
Chicago (at present)	10

An approximate idea of what it costs to build an electric street railway is given in the following figures on the Detroit system prepared by Prof. Edward W. Bemis:

175.95 miles of track	$4,350,183
Overhead trolley	760,939
One power house	440,894
One power house	366,249
One repair shop	8,003
Tools and supplies	75,990
Rolling stock	1,102,212
Car houses and land	523,248
All other buildings	179.016
Total (cents omitted)	$7,806,737

THE MODERN DRAMA.

How a Play is Staged—Actors and Actresses Preparing for Rehearsal—Difficult Learning of Parts—The Stage Director's Duties—How the Stage Carpenter Works—Real Cannon Brought Into Service—Powder and Wigs.

LITTLE is thought by the average theater goer of what transpires between the conception of the piece by the playwright, and its first presentation on the stage. Rehearsals, scenic workmanship, the manufacture of wigs, costumes and properties are scarcely thought of as the attention is absorbed in the interest of the play. It is, therefore, interesting to observe what are the preliminaries to the final production of the piece.

The first step is the reading of the play. Those who are to take part are assembled in some suitable room, and the piece is read aloud. The author is invited, by courtesy, to do this, but he usually excuses himself and the dramatic director delivers it. Thus the actors and actresses get the general setting, their relation to the others, the plot, etc. Each actor receives a typewritten copy of his or her part with the "cues," but not a copy of the entire play; the "cues" are the last few lines of the speech by the preceding actor. It is important to memorize these fragments as carefully as the part itself, for mistakes at these points would result in disastrous confusion.

The first rehearsals are gone through in ordinary clothes. The position of balconies, doorways, winding paths, bridges or floral bowers are indicated by chairs and other makeshifts. To begin, the parts are not committed to memory at once. The action of the first act is learned and the location of the actors on the stage thoroughly understood. The actors read their lines with no attempt at expression. The same afternoon the second act is gone through in the same way.

Learning Their Parts.

When these preliminaries are completed the director announces:

"Ten o'clock to-morrow morning—first act rough perfect without parts."

This means that the performers will be expected to be able to repeat their lines without manuscript on the morrow. All are not able to do this, and on the third day, if still imperfect, are severely reprimanded. By the end of the first week most of the actors have learned all that the author has set down for them to do—

action and language. The director then calls for rehearsal "letter perfect," which means that every one must be able to recite his part with absolute correctness —to the smallest word. Of course, this is frequently not accomplished, and that necessitates a "rehearsal for lines," when the performers sit in chairs and repeat simply the words of their parts with no attempt at action.

By the conclusion of the second week everything is committed thoroughly to memory. Actors never receive wages while rehearsing. The stage director is the autocrat of the theater, and his word is the law to which the players must submit. Were this not so, the actors, each striving for individual achievement rather than for the general effect, would radically upset the balance of the piece and the composure of the author. Especial pains are taken in the rehearsal of love scenes and such situations where the action plays such an important part in depicting the sway of the emotions. Here again the director is dictator; if the lover is not ardent enough, he, himself, places the hand where it should be. Most of the kisses given on the stage nowadays are real, but this is not rehearsed excepting once or twice, to be sure the effect will be just right.

The Stage Director.

The stage director is usually a gentleman, though some are boors, and deals with ladies and gentlemen. He is frequently a dramatic scholar and must possess a fine quality of dramatic instinct. He must know aside from precedent and rule whether that action is "the thing." When action and lines are "letter perfect" the "rehearsal with props" is the next step; that is the dress rehearsal with scenery, properties, etc., in proper position, just as it is to be the opening night. The director, the author and the manager constitute the audience and criticise and make changes. If there are any choruses, ballets or musical numbers these have been rehearsed, perfected, separately, and are now brought in in proper order. This is true also of the "off effects," which are the yelling of crowds, the raging of storms and other noises from behind the scenes.



TWO SOUBRETTES READY TO GO ON FOR THEIR ACT.

Meanwhile the scenic artist is at work. He proceeds according to written instructions of the author and makes a water-color sketch of each scene. If actual places are to be reproduced he photographs them or obtains pictures. Historic scenes are dug out of books and reproduced. He then makes water-color drawings on cardboard of each scene, carefully depicting everything. The parts are cut

out and mounted on a miniature stage from two to four feet long. Everything is adjusted by a scale just as architects' working drawings are. This miniature stage is then illuminated, corrections made, if necessary, and then, when accepted, is turned over to the stage carpenter, who constructs everything according to the scale.

Usually scenic artists are specialists and paint exclusively interiors, landscapes, or architectural scenes. They do little of the actual work beyond designing, but entrust all but the most difficult to subordinates, who reproduce their original design. The immense canvases are usually hung against the wall of the back of a stage in some theater and a working balcony erected before it. Such things as cannot be reproduced and enlarged by canvas and frames, as small rocks, fallen trees, broken cannon, etc., are done in papier mache by the property man, who also constructs everything that is not purchasable ready-made. A scene brings from $100 to $1,000, according to the nature and quality of the work.

The Stage Carpenter.

It is the business of the stage carpenter



A MAKEUP IN BLACK AND WHITE FOR A HOTTENTOT MINSTREL SHOW.

to build frames for the scenery, bridges, balconies, etc.; and opportunities for inventive genius abound here, for, in devising reversible scenes, in hinging pieces for convenient packing, and in many other ways, the stage carpenter may demonstrate his value. A clever craftsman makes $50 a week.

The matter of costumes is an important one. To a limited extent actresses are permitted to exercise their own taste in

selecting their gowns, but everything must be approved by the director, for an actress, if given latitude, might choose a color that would clash with the other costumes and the scenery. It has become the practice among managers to patronize the department stores for costumes rather than costuming concerns. The actress secures samples, has them approved, and then takes them to stylish tailors. She is allowed a fair but fixed amount for her gowns, but may add what she chooses at her own expense. Realism and naturalness are the keynotes of the stage to-day, and many of the ball-room gowns seen behind the footlights are made by the same tailors who cater to the wealthiest society women.

When costumes are to represent some previous age, historical accuracy is required and water-color sketches are made as working patterns. Old clothes are hardest to secure. To make a new costume and tear it does not contribute the appearance of age, so rubbing and stains are resorted to. Male actors who are to represent tramps do not hesitate to purchase direct from "Weary Willies," and after fumigation and some washing such costumes are wearable.

Guns From Battle.

The military uniforms, guns and other appurtenances of war used for scenic effects are quite often the witnesses of real battles, and are obtained from professional costumers, who keep on hand the apparel of various ages and countries, which have found their way into their possession after serving their purpose in plays long since abandoned. The wig maker, too, is a specialist, and his skill is usually expensive. An ordinary ready-made wig will bring $15, while a special varies from $25 to $100. Actors frequently allow their beards and hair to grow long when their parts require it, and actresses not uncommonly bleach and dye their tresses, especially if the piece is to have a long run.

Thus it is clear what a mass of detail contributes to the finished theatrical production. There is no inflection of voice,



A POSE FOR THE PLAY AND THE ORIENTAL DANCE—A SCENE FROM CARMEN.

no gesture, no blow, no embrace; there is no scenic view, no costume, no wig, no property of any sort that is not carefully rehearsed and constructed beforehand, and once approved by the director it is never executed in any other way. It is the practice in New York, when bringing out a play, to have the opening night not

in the metropolis, but in some small adjoining town.

The author by this means has an opportunity, before risking a performance before a metropolitan audience, of estimating the effect upon the auditors, and of making alterations and improvements which may be necessary.

RAILWAY BUILDING IN THE KLONDIKE.

How the Franchise was Purchased and by Whom—Obstacles to be Overcome—Opposition of Property Owners.

IN Alaska there is an enterprising little railroad which is pushing itself to the front rapidly, and bids fair to be a factor in the development of those regions. It is the White Pass & Yukon Railroad, and has been in existence for about two years. Although the greater part of the line exists merely on paper, the contractors are rapidly pushing the work, and within a few years a line from Skagway to Fort Selkirk will have been completed.

At present the road extends from Skagway to White Horse Rapids. Considering its size the road compares favorably with any other road in the world. All the miners' supplies, food, etc., are transported on this line. The road heads for Dawson and miners bound to that city are given a little help by the road as it now is. From White Horse Rapids to Ft. Selkirk the line has been surveyed, but the work of construction has been greatly impeded by the weather and topography of the country. There is a remarkable tale connected with the road.



ICE FLOES AND DRIFT ICE OFF OF THE ALASKAN COAST AND IN THE VICINITY OF THE FAMOUS MUIR GLACIER, AND THE WHITE PASS RAILROAD.

Purchased by Chance.

Strange though it may seem, it is a fact that the builders of the road purchased the franchise by chance when they knew absolutely nothing of the country beyond its reputation for coldness. The London firm was that of Close Brothers. Some

enterprising gentleman had acquired a right to construct a railroad in Alaska, but being unable to raise the necessary funds, he sold this right to a London company, which borrowed the money on condition that the loaners be permitted to assume the construction of the road in case the company was unable to see its way through. Close Brothers made the loan, and according to the agreement came into possession of the railroad.

This firm in turn dispatched their American representative, a civil engineer, to Alaska with instructions to build the road. He set about the task, and after many vicissitudes saw the first two miles of road constructed through the main street of Skagway. Much opposition was offered to the erection of the road even by those most benefited by it. Property owners advanced their prices for real estate in hopes of forcing the railroad company to buy. Traders and storekeepers handicapped the company in every way conceivable. But the road was built and is pushing its way through the frozen passes of the Northwest. It will cost when completed about $6,000,000.

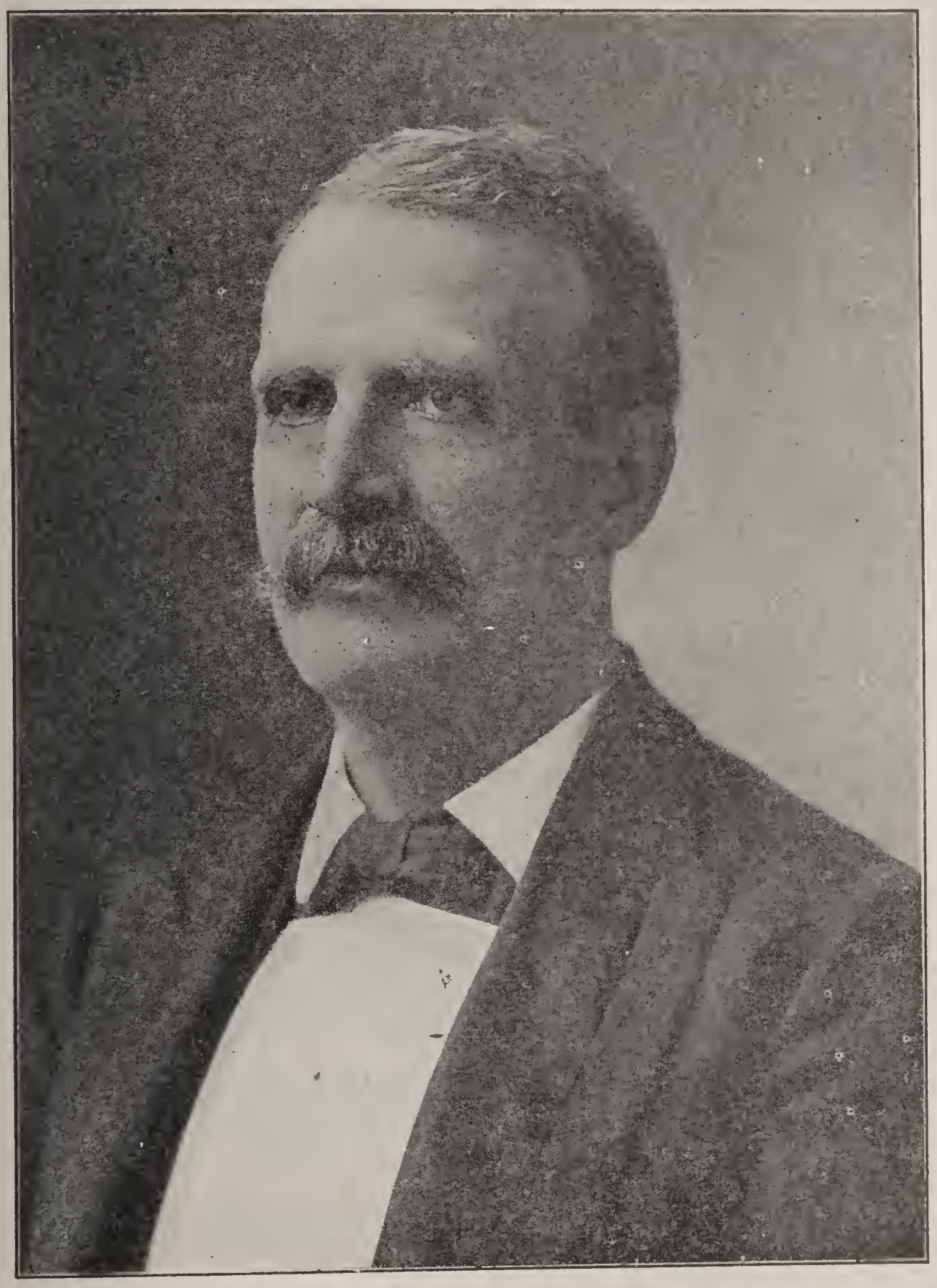
Postal Service of the United States.

Employes, Expenses and Revenues of the Department—Time Saving Devices—Value of Fast Mail Trains.

SOME idea of the enormous work undertaken and carried out by the Post Office Department may be had when it is considered that it directs the operations of 73,570 post offices and has on its pay rolls 200,000 employés. In 1899 the expenses of the department were $105,000,000 and the receipts almost as much,—for it must be said that, despite the efficiency of the department, the government is so liberal in the matter of second class postage that the department is not entirely self-sustaining. In 1898 the various offices handled 6,214,447,000 pieces of mail matter, of which 2,825,767,000 were letters. Thus the government delivers for its citizens every minute of the day some 12,000 messages.

There is a vast difference between the smoothly-working system of to-day, with its lightning mail trains, its free city and rural delivery and its gigantic money order department, and that of the old private pony post of the time of our grandfathers. During the term of office of Timothy Pickering, first postmaster-general under Washington, the receipts and expenditures of the department for a quarter of a year showed an aggregate of only $63,000, which is now spent by the department every six hours of the day. To-day the manufacture and delivery of postage stamps is a gigantic enterprise in itself. In 1898 alone there were made and distributed to the various offices postage stamps to the number of 3,623,821,608, valued at $71,788,333, and pound postage was paid for the carriage of 2,069,742,000 newspapers.

Four great branches, each under the immediate charge of an assistant postmaster-general, conduct the operations of this enormous government business.



HENRY C. PAYNE
Postmaster General

They are: First, the department for administration of the post offices, the carriers and clerical force, and the actual management of the general work of the offices. The annual expenditure of this branch of the service is over $40,000,000. Second, the department for the transportation of mails,—which sees to the contracts for the railway service, etc., and which operates at a cost of $35,000,000. Third, the department that conducts the financial side of the service, furnishes stamps and keeps accounts; and, Fourth, the branch that appoints over 70,000 postmasters and directs the force of inspectors. Besides these departments there is the auditor's office employing 500 clerks and which is a bureau of the Treasury. Through it all post-office accounts pass for scrutiny and audit.

New York Postal Revenue.

Revenue from the numerous offices throughout the country varies greatly, that of the New York post office being more than $8,000,000 annually with a net profit to the government of about $5,000,000, while many of the little cross roads offices do not sell $25 worth of stamps a year. The salaries of the postmasters vary; those appointed by the President

are about 3,800 in number and command not less than $1,000 yearly. The fourth-class offices in which the salary is less than $1,000, are over 70,000 in number and appointments are made by the postmaster-general.

Some of the branches of our service command especial respect, and excel in efficiency similar bureaus in foreign countries. One of those which is greeted with popular approval is the free delivery system which employs 140,000 carriers at an annual expense of $14,000,000 and which brings mail to the door of every resident of the larger cities without the least inconvenience. The marine service on the Great Lakes is marvelous in its magnitude and smoothness of operation. Eight months of the year at the mouth of the Detroit River vessels pass every three and one-half minutes of the day and night. Here every steamer must be met and the mail collected and delivered without slowing up. The great fleet has a postal system which is carried out effectively and which enables every seaman absent from home to receive or send mail without delay. Letters are stamped on the back with the name of the steamer to which they are to go. Water-tight bags are used in case the boats making collections are upset, and so thorough is the system that every boat is met and served as easily as though they were only so many post boxes on land.

Thousands are Employed.

Started in 1864 the railway post office now employs 8,100 men, and had in service in 1898 cars that covered a total of 281,585,612 miles on 174,000 miles of railroad track. In 1884 there were distributed in railway post offices 4,519,661,900 pieces of mail; in 1890, 7,865,434,101, and in 1898, 12,225,706,220, so it may be seen that the increase in that branch of the service is tremendous. To-day, mails are handled, sorted, pouched and delivered to every point desired without the least delay at the distributing point. Clerks on the line must know every office in the territory and no flaw in memory or inaccurate throw to a wrong pouch is excusable. When applicants wish to enter the railway service extremely difficult examinations must be passed. The entire scheme of the territory must be memorized. Before this examination was compulsory one error occurred in every 720 letters. In 1884, however, this had been reduced to one in every 4,152. Through changes in the administration in 1888 the efficiency dropped to one error in every 3,694 pieces of mail, and in 1890



A TELEPHONE CONVERSATION.
Showing manner of holding receiver, and answering.

even to one in 2 834. Extra diligence on the part of the inspectors has brought back the record, however, to the almost perfect mark of only one error in 10,428 pieces sorted and delivered.

Time saved is the object of the railway service and in order to effect this saving fast mails had to be originated. Now a fast mail train crosses the continent four hours ahead of any passenger trains. Between Chicago and Omaha the lightning rate of from 80 to 90 miles an hour is often reached. To secure this rapid travel small stations must necessarily be skipped. The mail, however, is always picked up and delivered, while the trains rush past, by the "catcher-pouch" system. This consists simply of a post to which is hung the mail bag to be taken on board the flyer, loosely secured with twine or on a hook. A sort of crooked arm is attached to the doorway of the car, which, upon being operated by a lever, reaches out and grabs in the pouch. At the same time any mail to be delivered to the station is thrown off by hand, or, with some systems, pushed by the arm and attached to the post while the other is being collected. This service is rather dangerous, in 1889, sixty-nine clerks were killed and 1,324 injured while on duty.



UNITED STATES POSTAL CLERKS.

At work on a fast mail train between Chicago and New York. Pouching the mail.

Mail Service on Cars.

To save time in the final delivery of the mail intended for the larger cities a city distribution service is maintained on board the fast mail trains, and so effectual is it that the mail may be taken in the bags direct to the sub-stations in the city without a moment's delay. This system of course necessitates employing men who thoroughly understand the lay of the city.

Bags for the service are supplied by contract and are nearly all fed into service through the New York office. The great trend of mail is from the east to the west and from the large commercial cen-

ters to the country. There are certain offices in every district where bags naturally accumulate and whence it is easy to send them once more into the service. Cincinnati and St. Louis are made distributing points and either city is ready to supply from 5,000 to 20,000 bags at one shipment. Each year over a million and a quarter are repaired and fed through the offices at Washington, Baltimore, New York, Chicago, Boston and Philadelphia. The great outflow of bags is around the Christmas holidays, returning the latter part of January, only to pour out from the commercial centers once more in the advertising season in May. Bags of all sorts are in use and new ones are constantly demanded. There must be the bag for the mountain carrier and for the runner on snow-shoes, knapsacks and bags for the Alaska dog teams and saddle bags for the pony express. The latest application for a special equipment called for a perforated bag for mailing queen bees from the Pacific coast to the islands of the Pacific. Heretofore ordinary sealed sacks have been sufficient for mailing these live packages, but the trip across the ocean is so long that the bees are likely to be suffocated.

A word about the celebrated "star" routes is necessary. Considerable scandal prevailed over contracts let for these routes in the early days. The way they obtained their name was by the act of Congress which specified the mail was to be carried over routes which could guarantee "celerity, certainty and security." The mark XXX was used to designate these routes, and when the bribery and fraud arose the natural reference was made to the "star" routes. These lines consist mainly of coach routes, etc., and altogether there are in operation some 2,200 of them. There are four seasons, one each year, for making bids for these contracts and the forty-one bids for each route in 1898 aggregated 218,000. Bidders are mainly speculative, and it is an old fact that the local carrier will eventually do the work for the successful bidder more cheaply than he does it at first hand for the government. The longest star route is from Juneau, Alaska, via Circle City in the same territory, along the Yukon River, to Tanana, a distance of 1,618 miles. The next longest is from Tanana to St. Michaels, 900 miles.

Big Money Orders.

The money-order division of the post-office department is one of the greatest clearing houses in the world. In 1898 money orders to the number of 29,000,000 were issued for amounts totaling $205,000,000. Three hundred and fifty clerks are employed in this division who do nothing all day long but add up long columns of figures. Our money order department, however, is far behind many European offices. Germany issued in 1898 100,000,000, amounting to $1,800,000,000; Great Britain, $310,000,000. But it may be explained that the post office money order system has been established longer in those countries.

Letters that are misdirected, unaddressed or unclaimed, and which have to go to the dead letter office for identification number 20,000 every year. In 1898 nearly $1,000,000 was thus sent back to its rightful owners. The same year over 50,000 parcels with no addresses at all, and many of them containing snakes, dynamite and curious freaks were disposed of by the office.

Until 1874 there were no uniform rates for foreign mails. What rates there were were regulated mainly by treaties with the separate countries. To-day, however, five cents will carry a letter around the globe to find the person to whom it is

addressed. There are no general contracts with steamers, but rather fixed rates. On three liners there are sea post-offices the same as on our fast mails, and mails thus transported may be given directly to the carriers in the local districts for delivery without going through the land offices. In the harbor of New York the transfer boat "Postmaster General" meets all steamers and carries the tons of mails between them and the trains.

Postal Delivery Post.

One feature being developed by the mail service is that of carrying parcels.

At present in the Western Hemisphere sixteen countries and colonies can be reached by service that will carry packages weighing up to eleven pounds. This branch is growing also in Europe, and threatens to undo the express companies. The postal delivery is a great convenience to the public.

BORES IN THE EARTH.

Europe Leads in Great Tunnels—France and Italy Have Many in the Alps—The Great St. Gothard's Bore—One Sought for the English Channel —Method of Driving Through a Mountain Wall—Tunnels in the United States.

THE United States, though it passes the world in many respects, does not lead as a country of tunnels. The only American tunnel more than a mile and a quarter long is the Hoosac, which has a length of four and three-quarter miles, and in which the builders broke no records except those for slowness and expense. It cost $15,000,000, and took twenty-one years to build.

The regions in which tunnels reach the greatest size are those of the Alps, where the people point with pride to the Arlberg tunnel, six and a half miles long; the Mount Cenis tunnel, seven and a quarter miles; the St. Gothard, nine and a quarter miles long, and the Simplon, which will be twelve and a quarter miles in length when its builders get through the mountain.

It was about 1855 when the people of France and Italy became tired of walking over the Alps, and packing by mules, and they resolved to have a tunnel. They began work in 1857 and proceeded to cut their way into the heart of the everlasting hills with pickaxes and crowbars. Working both in France and Italy, they could bore only eight feet a day, and in some places only two feet a day. After digging at the living rock for five years it occurred to a Frenchman named Sommeiller that time could be saved by the use of machinery. He invented a drill that could bore a hole in twenty minutes that two workmen could not dig in two hours. After that the tunnel in the Alps progressed more rapidly, and toward the finish the progress was fourteen feet a day. The tunnel was finished in 1871.

The Famous St. Gothard's.

Tunnel communication was hardly established between France and Italy when work on the St. Gothard railway was begun. This resulted in connecting Italy and Switzerland through the most stupen-

dous system of tunnels in existence. This road, though quite short, cost more than $52,000,000. It passes through one of the most mountainous countries in the world, crossing fourteen viaducts, 115 bridges and traversing seventy-nine tunnels, having a total length of nearly thirty-one miles.

Running southward from Lucerne the St. Gothard railroad follows the valley of the Reuss River, rising gradually as it passes the jagged Spannorter and the strangely contorted glacier of Schlossberg. Every mile of progress means an ascent. The route lies past the Bristenstock, the Oberalphstoch and the Grosse Windgall, — mountains over 10,000 feet high. At last, when the grade becomes so steep that no train can climb it, the locomotive dives into the interior of the mountain and begins climbing upwards after the fashion of a corkscrew. Inside the Pfaffnesprung loop tunnel the train mounts 155 feet, coming out on a terrace where the ascent is less difficult, and then plunging into the Wattinger loop tunnel, in which it ascends seventy-five feet. The route then turns upon itself and the train countermarches in a long loop to the Liggestine loop tunnel, in which an ascent of eighty-two feet is made.

Presently the great tunnel of St. Gothard is reached and the train clangs through nine and a quarter miles of solid rock. It then begins its descent, corkscrewing its way down through the insides of four mountains, at last reaching the plains, more than 3,000 feet below.

A solid mile of earth presses down on the tunnel of St. Gothard, and above it 6,000 feet towers the Kastelhorn. The tunnel passes under the Lake of Sella, and between the lake's bottom and the roof of the tunnel is two-thirds of a mile of earth and rocks. A thousand feet above the tunnel there is a village called Audermatt, standing by itself on a little lonely plain. The pressure of the earth at this point on the tunnel was so great that it crushed the tunnel twice, and now it is only held intact by huge arches of masonry, fifteen feet thick at the sides, and ten feet at the roof. It took nine and a quarter years to build the St. Gothard tunnel,—a year for each mile,—and its cost was $11,350,000. With all the improved drills, compressed air, etc., the workmen averaged only fourteen and a half feet of progress a day.



ST. GOTHARD'S FAMOUS TUNNEL ENTRANCE, PIERCING THE ALPS. IT IS 9¼ MILES LONG.

Great Bores of the Alps.

The third great transmontaine tunnel is the Arlberg. It is six and a half miles long,—almost as long as the Mt. Cenis,—and yet it took less than one-fourth as long to build it. Begun in 1880, it was finished in 1884, having progressed at a rate of twenty-seven and three-quarters feet a day. It connects the province of Von Arlberg with the rest of the Austrian Tyrol through the Arl mountains and facilitates trade between Austria-Hungary and France.

One of the earliest European tunnels built successfully was that by Prince Torlonia, between 1854 and 1876, at a cost of $4,800,000, and was over the route used in the old Roman days by Emperor Claudius. That ruler is said to have employed 30,000 laborers upon it for eleven years, the purpose being to drain Lake Fucino which at that time covered 48,000 acres of arable land. Soon after the Roman tunnel was completed it fell into ruins and remained useless until restored by Prince Torlonia. It is now three and a half miles long and is in places 400 feet below the surface of the earth.

The first tunnel built in the United States was constructed between 1818 and 1821 and was on the Union Canal. It was 450 feet long, twenty feet high and eighty feet wide and has long since been made into an open cut. A noted subaqueous tunnel in America is that built by the Grand Trunk Railway under the St. Clair River. It took twenty months to make this bore of 6,050 feet and the cost was $3,000,000.

Wolseley Opposed a Tunnel.

The boldest tunnel ever projected was that under the Straits of Dover, which would have been twenty-one miles long. Lord Wolseley declared that it would facilitate the invasion of England from France, therefore it was abandoned. Two of the most recent tunnels are under the Thames River at Blackwall for carriages, and under the Spree River in Germany for street cars. The Croton aqueduct which carries water to the city of New York is thirty-three miles long and is one of the greatest engineering feats in the world. The longest under-water tunnel in the world is that under the Severn River in England. It is four and a half miles long and was opened in 1885 after twelve years of building. Several times there were breaks in this tunnel, followed by an inflow of water, and once a high tide flowed into the shafts and swamped the whole tunnel. Divers were employed to close the bulkhead doors, which were 1,000 feet from the shaft, but were unable to carry the rubber air pipes that far. At last the chief diver took the dangerous task, and tying a reservoir of compressed air on his back waded through the water and closed the doors.

The western railroads of the United States have many notable tunnels. There is one on the Great Northern in Montana which is over 6,000 feet in length. Mullen's tunnel, on the Northern Pacific Railroad, pierces the Continental Divide of the Rockies. American railway builders avoid tunnels as much as possible, substituting for them horseshoe curves and loop curves, rising one upon the other. These are less expensive than tunnels and give comparatively easy access to the mountain heights.

NATIONAL PATENT LAWS.

They are Issued in the Name of the United States—Granted to Any Rightful Inventor—No Separate Patents Issued—Manner of Taking Oath—Fees That Are Charged.

PATENTS are issued by and in the name of the United States under the seal of the Patent Office to any person who has invented any new and useful art, machine, manufacture or composition of matter, or any new improvement thereof, not used or known by others in this country, not already patented, and not printed or described in any publication of this or any foreign country prior to the discovery, and not on sale or in public use for more than two years before application unless same can be proved to be abandoned. Patents are granted to any person who, by his own industry, genius, effort or expense, has invented and brought forth any new and original design for manufacture, bust, statue, alto-relief or bas-relief; designs for printing woolen, silk, cotton or other fabric; any new or original ornament, impression, pattern print or object to be printed, painted, cast or otherwise to be reproduced; or any new shape of an article for manufacture not heretofore patented, produced or described in a printed publication.

Every patent contains a grant to the patentee, his heirs or assigns for the exclusive right for seventeen years to the use of his discovery in the United States and the territories. If an inventor believes at the time of application that he is the discoverer of the invention, and part of his article for patent has already been known in a foreign country, the patent will not be denied, if it has not been patented or described in a printed publication

No Separate Patents.

When two persons work together on an invention they cannot receive separate patents on the several parts of such invention, but must have a joint patent, which cannot be claimed separately.

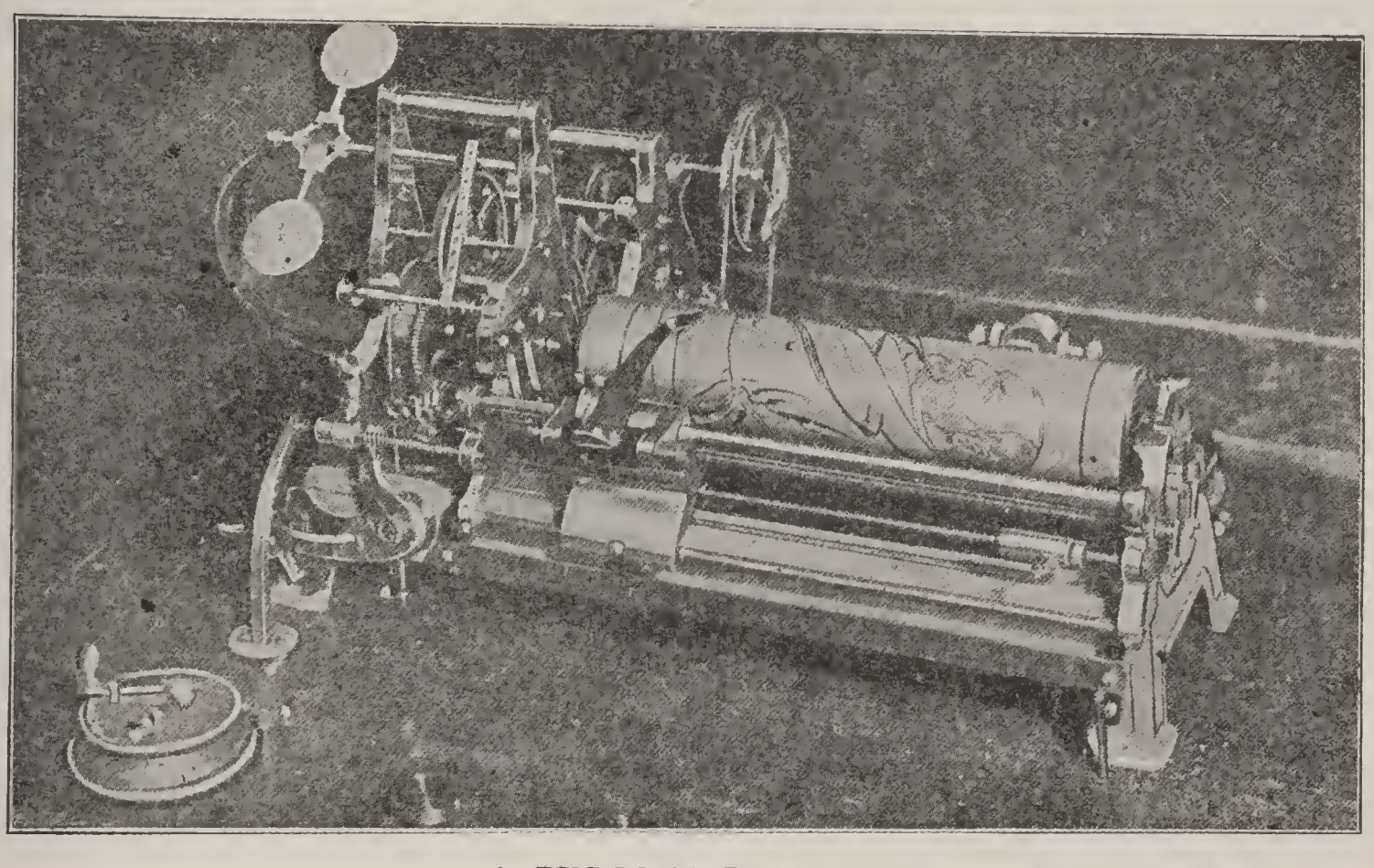
If a foreign patentee apply for a patent in this country the fact that the invention has been patented in a foreign country will not prohibit him from securing it unless the article patented has been put into use here more than two years prior to the time of application. But every patent thus applied for will expire at the time of the foreign patent, unless there are more than one, in which case the United States patent will expire at the same time as that which has the shortest unexpired time, and in no case will a patent run more than seventeen years.

Applications for a patent must be made in writing to the Commissioner of Patents, and at the same time there must be filed in the Patent Office a written description of the invention with its manner of making, construction, compounding and method of use in such clear and concise language as to enable any person versed

in the science to which it pertains to be able to make it. In the case of a machine the principle must be explained and the best mode for its use be provided, so as to distinguish it and its improvements from other similar inventions. These specifications must be signed by the inventor and attested by at least two witnesses. When the nature of the case admits of a drawing of the invention the patentee must furnish one copy signed by himself and attested to by two witnesses, and when a model is possible the applicant, if required by the Commissioner, shall furnish a model of convenient size to exhibit to advantage the several parts of his invention or discovery.

missioned member of the diplomatic corps of the United States, stating that he believes his invention to be new and original, that he is the rightful discoverer and that the same has never before been known or used. After filing such an application, the patentee if the Commissioner thinks an issue is justified, shall upon the payment of the lawful fees receive letters patent.

Assignments are lawful, and any patent or interest therein shall be assigned by an instrument in writing, and the patentee or his assigns may grant and convey an exclusive right under his patent to the whole or any specified district of the United States for the use or sale of his patent. In case of an error or inadvertence, where more is claimed by the patentee than he is entitled to, the patent becomes invalid. But by filling out certain papers showing such error to be by mistake or accident the reissue will be granted.



A CURIOUS PATENT.

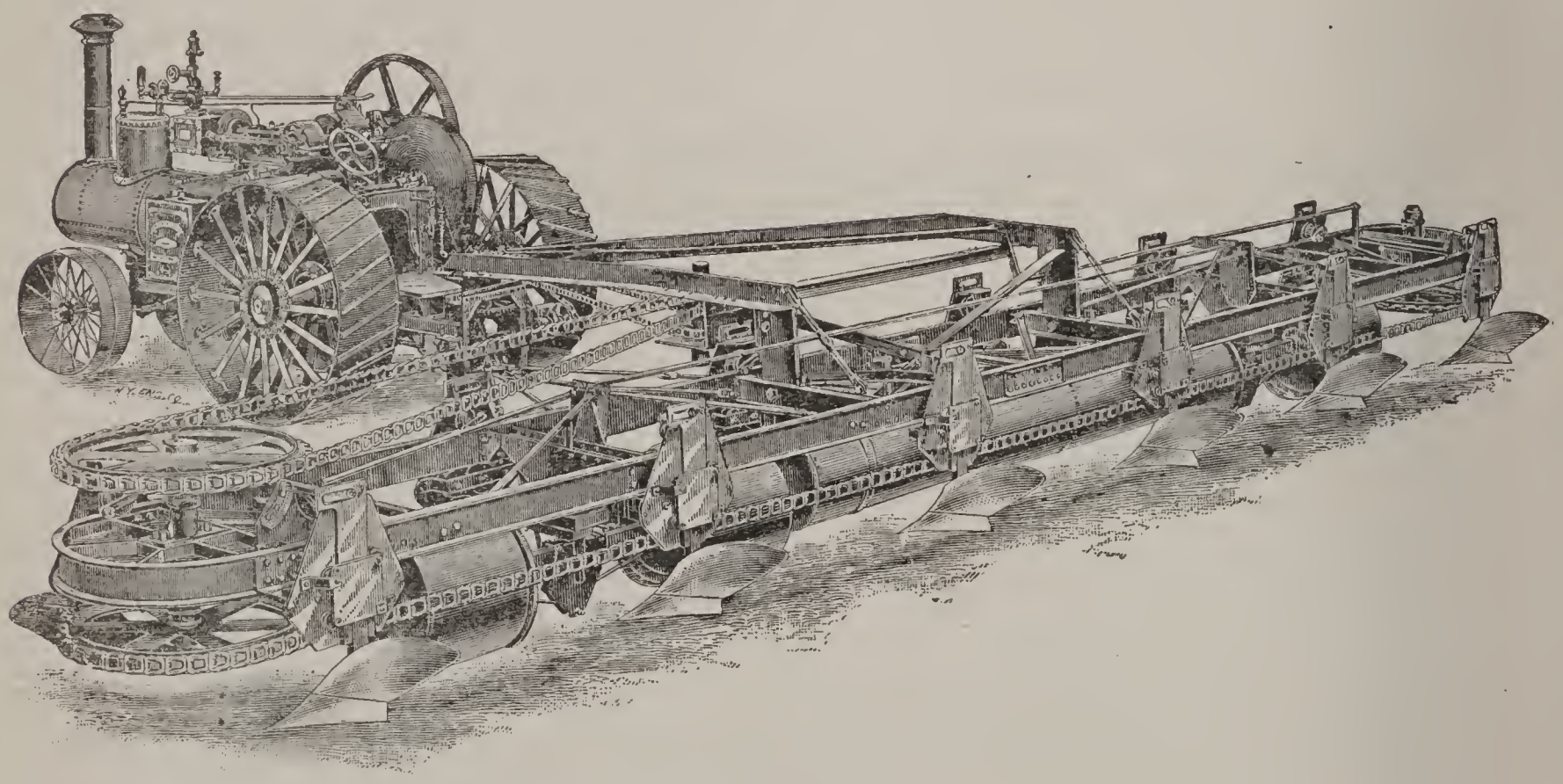
The machine by which great newspapers telegraph pictures to each other over ordinary telegraph wires, the same as news. Used by the New York *Herald* and Chicago *Times-Herald*.

How to Make Oath.

The applicant for a patent must make an oath before some person in the United States authorized to administer it, or if residing abroad before some duly com-

Explanation of a Caveat.

Caveats, under the patent law, are notices by which the caveator informs the Commissioner of Patents that he has an invention, in order to prevent a patent to another of the same alleged invention upon an application during the life of the caveat without notice to the caveator. A caveat may be secured on payment of a $10 fee and filing the distinguishing characteristics of the invention with the Patent Office, and will protect the inventor from any other inventor securing letters patent on such an invention during the life of the caveat, or one year. An alien in the United States has this privilege in common with an American citizen, provided he has lived here one year prior to filing the caveat and has declared his intention to become naturalized. Patent fees must be in advance, and are: On filing original application, $15. In design cases, for three years and six months, $10; seven years, $15; fourteen years, $30. Filing caveat, $10. Each application for reissue of a patent, $30. Filing each disclaimer, $10. For certified copies of patents, printed copies, etc., 10 cents per hundred words. Recording assignments, powers of attorney or other papers, three hundred words or under, $1; over three hundred words and under a thousand words, $2; over a thousand words, $3. Reasonable charges are made for copies of drawings. All letters in regard to patents should be addressed to the Commissioner of Patents, Washington, D. C.



A STEAM PLOW.

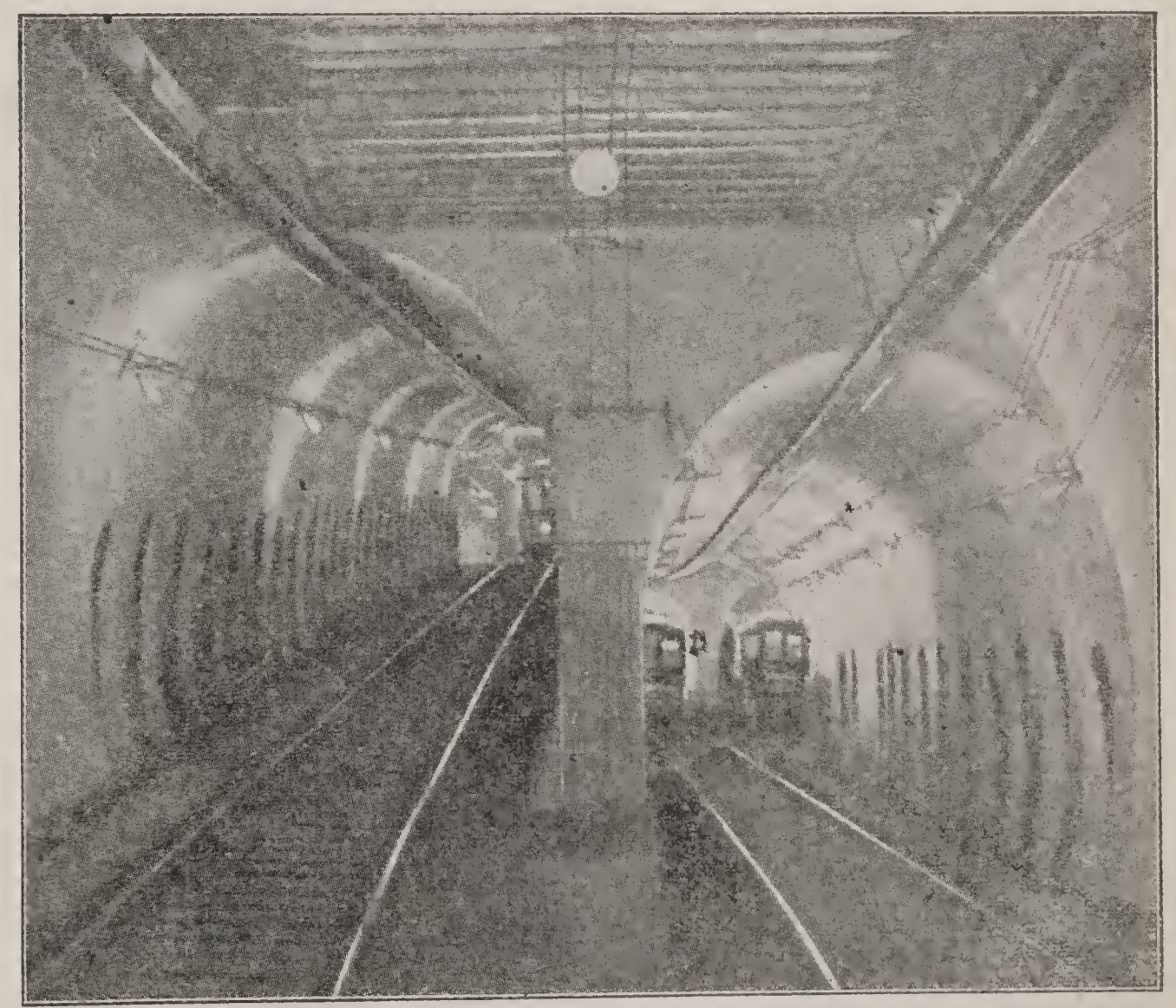
The travel of the plows is at right angles to the travel of the engine. The plow has been given a successful trial.

UNDERGROUND RAILROADS.

London's Great System Now in Use—Millions Expended on the Work—New York Starting to Build in this Way—Speed Which May be Attained.

FOR years the greatest engineers in the world have been trying to devise some scheme for removing the street car from public thoroughfares. This has been accomplished, and a problem which formerly seemed gigantic was made practical by Londoners. In the great metropolis of the world there are three underground railroads. These lines have a mileage of 105 miles, and it is the greatest and only system of its kind in the world. Something like $200,000,000 were expended in its construction, but the owners are being rapidly repaid for their great work.

The system is the work of several years and scores of contractors were employed before the monstrous task was completed. London, however, will not enjoy its distinction in this line alone. New York, which is its greatest rival in commerce and population, will also rival, if not surpass, it in the underground railroad proposition. The New York Rapid Transit contract is the largest single contract ever let, and is in the hands of John B. McDonald. It is a great undertaking when it is considered that this man attempts to solve in three years the transportation question for the most crowded city on earth; to dig twenty-one miles under streets which are alive with traffic



AN UNDERGROUND RAILWAY.

Showing the shape of the tunnel and the manner in which cars pass each other. This is the Boston method.

and threaded with conduits, sewers, and gas mains.

Its Speed.

According to the announcement of the promoters the new railroad, when completed, will make possible the traversing of a territory twenty-one miles in extent, in eighteen minutes. By the present system, it requires one hour. The line will be an electric road, with individual motive power fitted to each car, which is new for underground railroads. The entire right of way has been surveyed and even minor details have been arranged for. The tunnel will be fifty feet wide and seventeen feet high. It will traverse the city from the post-office to Ninety-sixth Street. The tunnel will be so constructed that four tracks will be accommodated. Two will be used for express service and two for local. Where the tunnel will run near the surface—at stations—the roof will be flat and constructed on pillars.

From the post-office to Thirty-third Street will be one main tunnel. At this point the tunnel will branch into two tunnels, owing to the Fourth Avenue tunnel, which begins at that point and runs near the surface. At Forty-second Street the single tunnel will be resumed and continue to the terminus at Ninety-sixth Street. The underground stations will be entered from the sidewalks. There will be separate staircases for entrance and exit. The station walls will be constructed of enameled brick and electric lights will be placed in niches in the walls.

MANUFACTURE OF SALT.

Apparatus for Mining Purposes—How it is Manufactured—Famous Wells at Manistee and Their Capacity.

KANSAS, once regarded as a desert, is now one of the best salt fields in the United States. In the vicinity of great forests, where saw mills are located, it is common to erect "salt blocks" in order to make use of the refuse of the saw mills as fuel. One of the states that thus manufactures a great deal of salt, and has employed one of the best methods of manufacture is Michigan. Near Manistee, underlying the great forest, is a stratum of rock salt from twenty-five to thirty feet thick and lying about 2,000 feet below the surface.

To mine this salt a derrick about eighty feet high is built over a point selected for a well and the work of driving commences. A ten-inch pipe is sunk by means of a sand pump to a depth of about 400 feet, and then within this pipe is inserted an eight-inch pipe, both being driven to the rock stratum. From the well thus constructed an air pump forces brine to the surface at the rate of 2,000 to 2,400 barrels in twenty-four hours.

Storage Cisterns.

As the brine is pumped up it is delivered to storage cisterns, whence it is pumped later on to be subjected to a system of boiling and evaporation to reduce it to granular salt. From the cisterns it is taken off to settlers where it

is heated to 170 degrees F. and then allowed to cool so that the impurity of gypsum will be removed by precipitation. If this were not done the gypsum would form a coating on all the steam pipes and clog the machinery.

Then the brine is drawn off into a long box which extends over the end of a device called a "grainer." The grainer is a long shallow tank, in the bottom of which is a series of steam pipes. The brine being admitted to the grainers, the steam is turned on, the liquor soon reaches a high temperature, and rapid evaporation takes place. To assist in the formation of the grains of salt by evaporation, the brine is stirred by a series of paddles worked by a lever. The salt rapidly accumulates at the bottom of the grainer as the brine cools off, and in twenty-four hours there will be a layer six to eight inches deep. From this trough the salt is lifted by perforated shovels to a runway, whence it is shoveled into carts as soon as it is drained, and is taken to the storage bins and dumped.

Manistee Salt Wells.

One plant near Manistee consists of five wells, three cisterns, each 18 feet wide by 100 feet long and 8 feet deep, and six settlers, 175 feet long and 8 feet deep, capable of holding 24,000 barrels of brine. When these cisterns and settlers are full they hold enough brine to manufacture 10,000 barrels of salt.

Part of the salt manufactured is treated to what is known as the "vacuum-pan" process. This consists of heating the brine in a large air-tight cylindrical



GREAT SALT BEDS, WORKED BY THE NATIVES, NEAR MAKHOA, COREA.

boiler by steam heating process. Part of the air pressure is removed, which allows the brine to boil at 150 degrees. So rapid is the evaporation of the salt by this method that the grains fall to the bottom of the "pan," and by means of an endless belt "bucket" elevator the salt is automatically carried and dumped into drainage bins. Here it drains for about eighteen hours, and then is stored in bins. It is unusual to work the vacuum plants over twelve hours, since they should be cleaned out with fresh water frequently. Some plants have two pans, one for night and another for day work. Each can turn out from 600 to 700 barrels of salt a day.

Great Salt Bins.

Manufacturers of salt generally keep a large supply on hand in their bins, some of which are 200 or 300 feet in length. Frequently the salt becomes caked and hard. Then a gang of men must use shovels and picks to loosen it up for packing in barrels. The coarser grades do not pack so hard, but vacuum-pan salt sometimes becomes like a wall of marble. Then it is dangerous work to undermine it. To overcome the delay thus occasioned, ten-inch compressed-air driven augurs are used to drill holes in the stored salt. These augurs are mounted on trucks, and can readily be shifted about. A row of holes driven under the salt about ten inches from the floor to a depth of about six feet will bring down enough salt in a half-day's work to keep a gang of men busy packing for several days.

The salt wells of Kansas are found in the western part of the State, and those of Syracuse, New York, are quite famous. Vast quantities of salt are now obtained from Salt Lake, in Utah, by the evaporation and drying process. The salt producing States of the United States are New York, Michigan, Ohio, Louisiana, West Virginia, Nevada, California, Kansas and Utah.

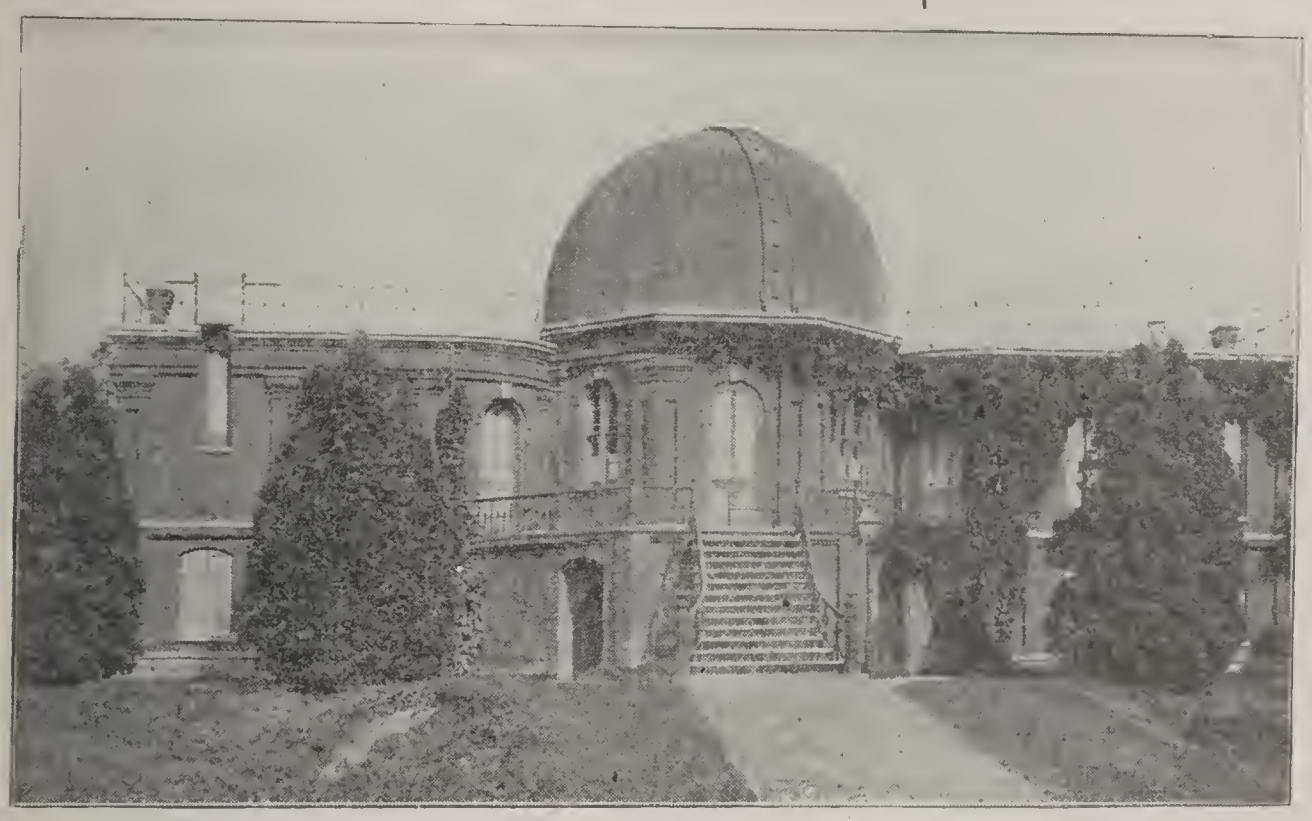


OUR NATIONAL TIME.

How Solar Time is Determined—Regulating the Clocks of the Country—A Million a Year for Telegraph.

TIME is bought and sold throughout the United States to the extent of one million dollars' worth per year. The Western Union Telegraph Company is the monopolistic agent in this marketing of time. An important part of the daily routine at the Naval Observatory in Washington is the determining and free distribution of the correct time at noon each day. The government's salaried experts make the computation, and communicate by the pressure of a button the precise hour of noon to each of the official departments in the city. The Western Union is permitted to keep its instruments in the observatory room from which the noontime message is flashed.

There is direct communication by beats from the official clock to the telegraphic instrument, so that the services of an operator are not required. Just before twelve each day all business must be taken off the wires controlled by the Western Union Company. Three minutes before noon, wire chiefs in each of the principal cities and the towns and cities leading to and from their larger sisters, cease sending or receiving messages, and devote themselves to switching on wires in such a way as to make an unbroken chain of communication from Washington around the uttermost boundaries of the United States. This is called an "unbroken national circuit." Ten seconds before the time bell strikes, there is silence; then a mighty throb, a titanic heartbeat from the foremost factor in modern commerce, and an electric current pulsates from east to west, from north to south, announcing the fact that the sun has passed over the



THE QUAINT OBSERVATORY AT VASSAR COLLEGE, POUGHKEEPSIE, NEW YORK.
Used by young women students. The stars are studied here.

seventy-fifth meridian and it is noon at Washington.

The manner in which the telegraph company reaps a rich harvest in the distribution of time is as follows: Those who have clocks and find it necessary to keep them right, to the fraction a of second, are willing to pay for such accuracy, and the Western Union first made the discovery that time is a profitable commodity. The clocks of the United States are kept correct by electricity for a nominal yearly fee, and in New York alone some 7,600 clocks are regulated daily and supplied with absolute solar time. For this service a charge of $15 a year per clock is made. This yields the telegraph company an annual income in the metropolis of $114,000. With 70,000 clocks to look after, it is easy to see how one million dollars is obtained annually.

Rarely Seen by Public.

Most of these electric clocks are never seen by the public. Dozens of them are in the big public buildings of the larger cities, in private offices, and in a single newspaper office in New York some fifteen timepieces are regulated from Washington.

The clocks that are set every noon in a thousand cities and towns by the mere pressure of a button in Washington are equipped with a peculiar electric contrivance, so that the current passes through them and springs the hands of each timepiece simultaneously to the point of twelve. While correct time is usually



THE LICK OBSERVATORY, MT. HAMILTON, CALIFORNIA.

Containing the next to the largest refracting telescope in the world. The largest was at the Paris Exposition of 1900.

referred to as solar time, the government timekeepers do not reckon solely by the sun, but by the so-called "fixed" stars, which are so far distant that their position with relation to the earth does not change within months or even years. Thus star time is the only true time. The astronomical operator looks through his big telescope, and watching for a given star knows when that particular star will cross the plane of earth line of the meridian. As it crosses he records the moment it does so, the time being given him by a clock having a twenty-four hour dial.

Then consulting a printed table the operator finds at just what number of hours, minutes and seconds the star in question must actually have crossed the meridian plane. The table being absolutely correct the difference shown between it and the clock proves to what extent the latter is wrong.

The clock is never set right. Allowance is simply made in subsequent calculations for the errors discovered, and these errors amount only to an infinitesimal part of a second in many days. After this procedure the corrected time as taken from the clock is reduced to solar or sun time, which involves considerable figuring, inasmuch as the star year is one day longer than the sun year. The solar time clock in the observatory is consulted at this point and the extent to which this varies from the truth having been ascertained, allowance is made for the error in sending the new message throughout the country.





COAL MINING NEAR TAYUEN FU, CHINA.

THE LARGEST THINGS IN THE WORLD

HIGHEST NATURAL BRIDGE in the world is at Rockbridge, Virginia, being 200 feet high to the bottom of the arch.

LARGEST CIRCULATION of paper money is that of the United States, being 700,000,000, while Russia has 670,000,000.

LARGEST INSURANCE COMPANY in the world is the Mutual Life of New York City, having cash assets of $108,000,000.

MOST REMARKABLE ECHO known is that in the castle of Simonetta, two miles from Milan. It repeats the echo of a pistol sixty times.

LARGEST VOLCANO in the world is Etna. Its base is 90 miles in circumference; its cone 11,000 feet high. Its first eruption occurred 474 B. C.

LARGEST TREE in the world, as yet discovered, is in Tulare County, California. It is 275 feet high, and 106 feet in circumference at its base.

LARGEST DESERT is Sahara, in Northern Africa. Its length is 3000 miles and breadth 900 miles; having an area of 2,000,000 square miles.

LARGEST DIAMOND in the world is the Braganza, being a part of the Portuguese jewels. It weighs 1880 carats. It was found in Brazil in 1741.

TALLEST MAN was John Hale, of Lancashire, England, who was nine feet six inches in height. His hand was seventeen inches long and eight and one-half inches broad.

HIGHEST MONUMENT in the world is the Washington monument, being 555 feet. The highest structure of any kind is the Eiffel Tower, Paris, finished in 1889, and 989 feet high.

IT IS CLAIMED that crows, eagles, ravens and swans live to be 100 years old; herons, 59; parrots, 60; pelicans and geese, 50; skylarks, 30; sparrow hawks, 40; peacocks, canaries and cranes, 24.

GREATEST CATARACT in the world is Niagara, the height of the American Falls being 165 feet. The highest fall of water in the world is that of the Yosemite in California, being 2550 feet.

MOST ANCIENT CATACOMBS are those of the Theban kings, begun 4000 years ago. The catacombs of Rome contain the remains of about 6,000,000 human beings; those of Paris, 3,000,000.

LARGEST NUMBER OF CATTLE ever received in one year was that of Chicago in the year 1884, being 1,874,984 beeves, 30,223 calves, 5,640,625 hogs, 749,917 sheep, and 15,625 horses. It required 9000 trains of 31 cars each, which, if coupled together, would reach 2146 miles.

LARGEST PRODUCING FARM in the world lies in the southwest corner of Louisiana, owned by a northern syndicate. It runs one hundred miles north and south. The immense tract is divided into convenient pastures, with stations of ranches every six miles. The fencing alone cost nearly $50,000.

UNION ARCH of the Washington Aqueduct is the largest in the world, being 220 feet; 20 feet in excess of the Chester Arch across the Dee in England; 68 feet longer than that of the London Bridge; 92 feet longer than that at Neuilly on the Seine, and 100 feet longer than that of Waterloo Bridge, London. The height of the Washington Arch is 100 feet.

LARGEST SHIP ever built, the Great Eastern, recently broken to pieces and sold to junk dealers, was designed and constructed by Scott Russell, at Maxwell, on the Thames. Work on the giant vessel was commenced in May, 1854. She was successfully launched January 13, 1858. The launching alone occupied the time from November 3, 1857, until the date above given. Her total length was 680 feet; breadth, 118 feet; total weight when launched 12,000 tons. Her first trip of any consequence was made to New York in 1859–60. She has been broken and sold for old iron.

IN 1775 there were only twenty-seven NEWSPAPERS published in the United States. Ten years later, in 1785, there were seven published in the English language in Philadelphia alone, of which one was a daily. The oldest newspaper published in Philadelphia at the time of the Federal conven-

tion was the *Pennsylvania Gazette*, established by Samuel Keimer, in 1728. The second newspaper in point of age was the *Pennsylvania Journal*, established in 1742 by William Bradford, whose uncle, Andrew Bradford, established the first newspaper in Pennsylvania, the *American Weekly Mercury*, in 1719. Next in age, but the first in importance, was the *Pennsylvania Packet*, established by John Dunlap in 1771. In 1784 it became a daily, being the first daily newspaper printed on this continent.

STATISTICS OF TWENTY LEADING LIBRARIES in this country show that, of over $500,000 spent, a little over $170,000 spent was devoted to books, while other expenses consumed $358,000. In the Mercantile Library of New York City it cost 14 cents to circulate a volume; in the Astor, 14½ cents are



THE EIFFEL TOWER.

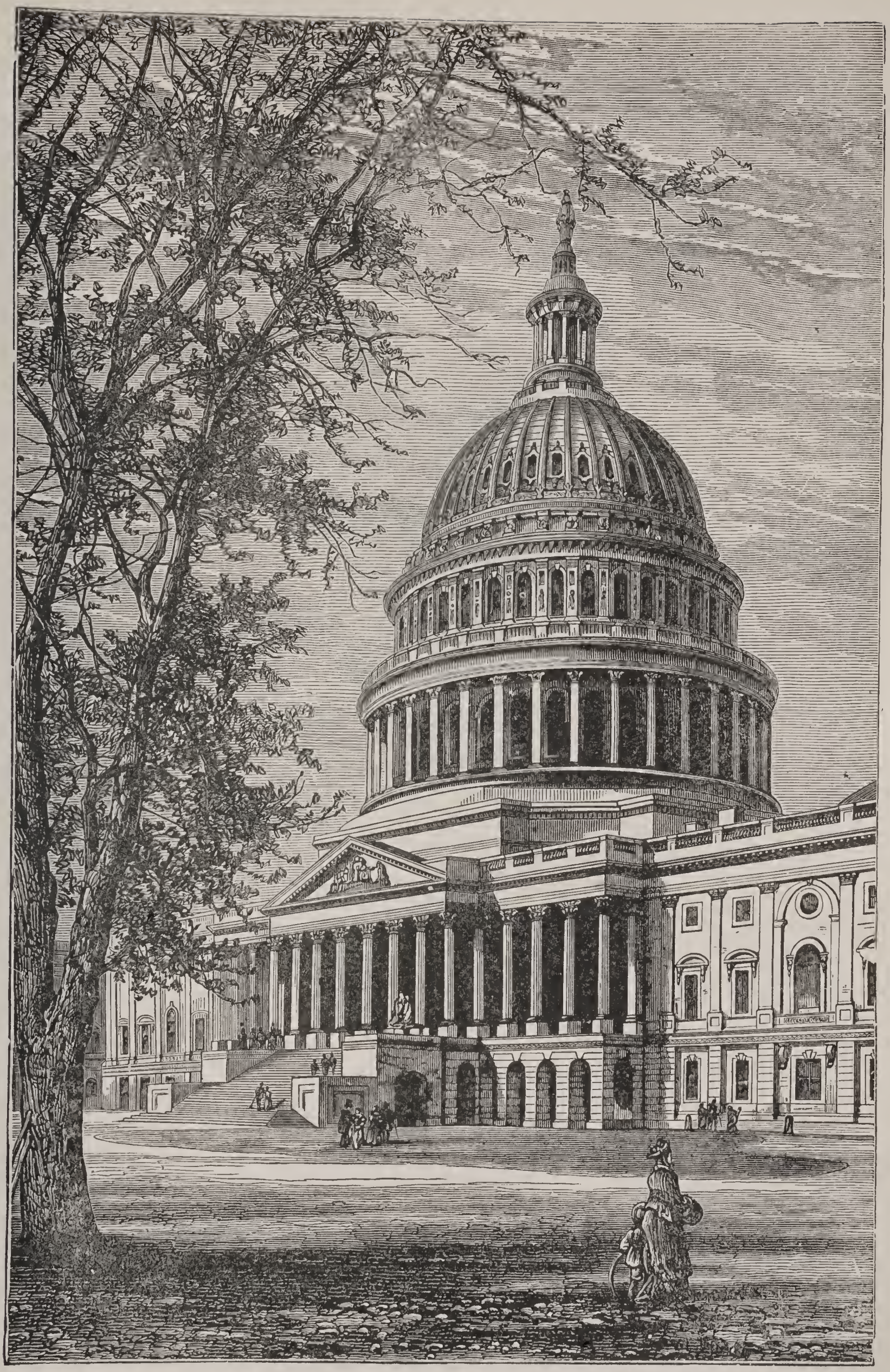
spent on each volume, or 27 cents on each reader; in Columbia College Library, 21½ cents per reader; in the Library Company of Philadelphia, 26 cents per volume, or 10 cents per head. The largest library in the world is the National Library of France, founded by Louis XIV., which now contains 1,400,000 books, 300,000 pamphlets, 175,000 manuscripts, 300,000 maps and charts, 150,000 coins and medals, 1,300,000 engravings and 100,000 portraits. The Library of Congress is the largest in this country.

MOST EXTENSIVE MINES in the world are those of Freiberg, Saxony. They were begun in the twelfth century, and in 1835 the galleries, taken collectively, had reached the unprecedented length of 123 miles. A new gallery, begun in 1838, had reached a length of twelve miles at the time of the census of 1895. The deepest perpendicular mining shaft in the world is located at Prizilram, Bohemia. It is a lead mine, 3280 feet deep. The deepest coal mine in the world is near Tourney, Belgium; it is 3542 feet in depth, but, unlike the lead mine mentioned above, it is not perpendicular. The deepest hole ever bored into the earth is the artesian well at Potsdam, which is 5,500 feet in depth. The deepest coal shaft in the United States is located at Pottsville, Pa., 1800 feet. From this great depth 400 cars, holding four tons each, are hoisted daily. The deepest silver mine in the United States is the Yellow Jacket, one of the great Comstock system at Virginia City, Nevada; the lower levels are 2700 feet below the hoisting works.

LARGEST STONE BRIDGE on the face of the earth is that finished in May, 1885, at Lagang, China. Chinese engineers had sole control of its construction. It crosses an arm of the China Sea, is nearly six miles in length, is composed entirely of stone, and has 300 arches, each 70 feet high. It is the most colossal structure ever reared by man, yet we sneer at "heathen Chinee." The largest truss iron bridge in the world crosses the Firth of Tay, Scotland. It is 18,612 feet in length and composed of 85 spans. The longest wooden bridge in the world is that crossing Lake Ponchartrain, near New Orleans, La. It is a trestle-work 21 miles in length, built of cypress piles which have been saturated with creosote oil to preserve them. The highest bridge in the United States is over Kinzina Creek, near Bradford, Pa. It was built in 1882, has a total span of 2,051 feet and is 301 feet above the creek bed.

"CENTENNIAL OX," bred by Samuel Barkley of Somerset County, Pa., was the largest specimen of the bovine the world has ever seen. He weighed 4900 pounds the day he arrived in Philadelphia. This mountain of beef was of mixed stock, being short-horn, native "scrub," and Ayrshire, the short-horn predominating. After the exhibition was ended the giant ox was butchered and exhibited as "show beef" at Philadelphia during the holidays of 1876. A short-horn steer weighing 4100 pounds was slaughtered at Detroit in 1874. A. [illegible]. Meal, of Moberly, Mo., formerly owned the largest cow in the world. Mr. Meal disposed of her in 1883, the Cole Circus Company being the purchasers She weighed the day of sale 3296 pounds. Mr. John Pratt, of Chase County, Kan., was formerly the owner of a cow weighing 3200 pounds. She was of the common "scrub" stock and stood nineteen hands high.

GREAT PYRAMID OF CHEOPS is the largest structure of any kind ever erected by the hand of man. Its original dimensions at the base were 762 feet square, and its perpendicular height in the highest point 486 feet; it covers four acres, one rood, and

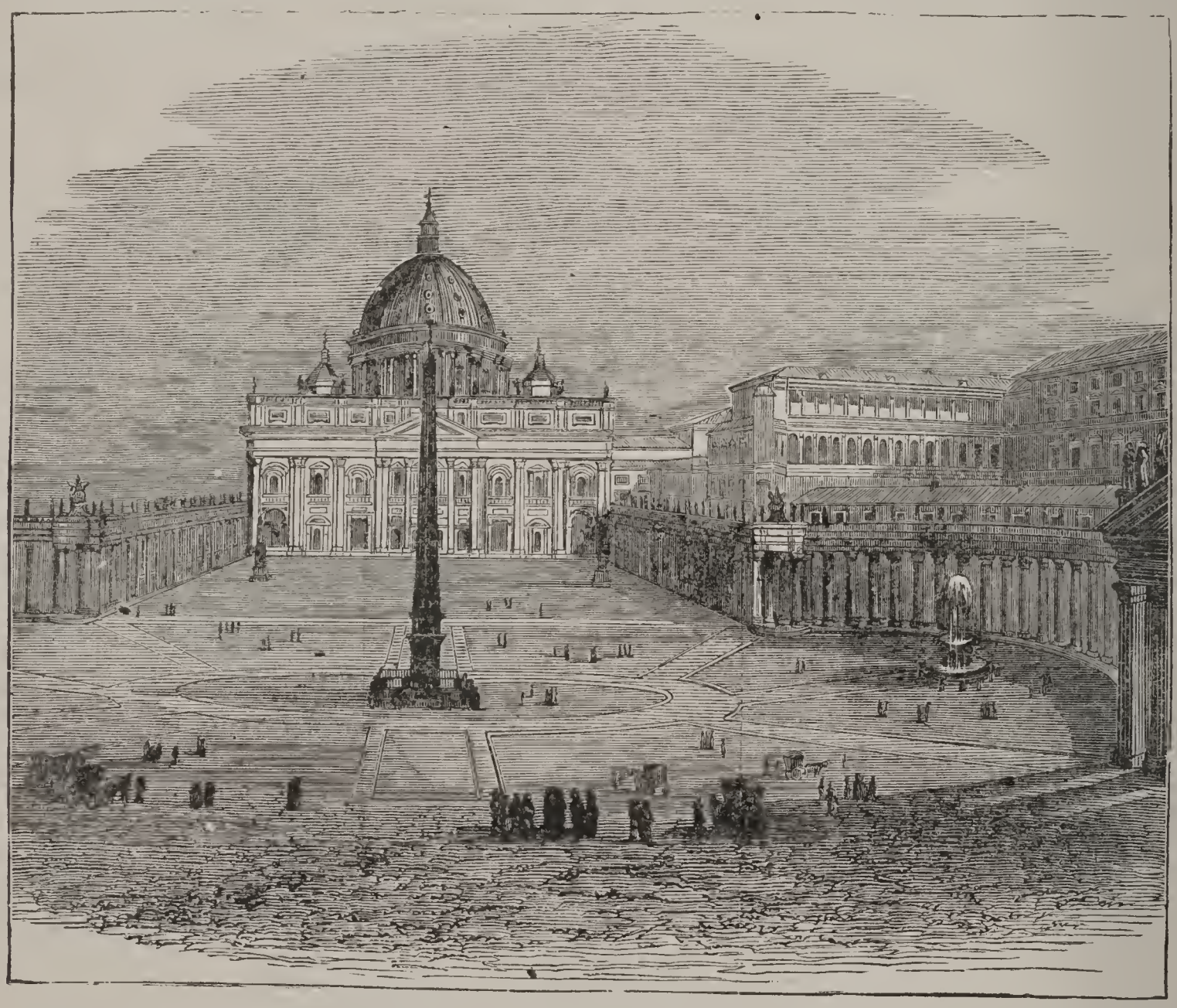


VIEW OF THE NATIONAL CAPITOL AT WASHINGTON.

twenty-two perches of ground, and has been estimated by an eminent English architect to have cost not less than £30,000,000, which in United States currency would be about $147,200,000. Internal evidence proves that the great pyramid was begun about the year 2170 B. C., about the time of the birth of Abraham. It is estimated that about 5,000,000 tons of hewn stone were used in its construction, and the evidence points to the fact that these stones were brought a distance of about 700 miles from quaries in Arabia.

LARGEST AND GRANDEST TEMPLE OF WORSHIP in the world is the St. Peter's Cathedral at Rome. It stands on the site of Nero's circus, in the northwest part of the city, and is built in form of a Latin cross. The total length of the interior is 612½ English feet; transept, 446½ feet; height of nave, 152½ feet; diameter of cupalo, 193 feet; height of dome from pavement to top of cross, 448 feet. The great bell alone without the hammer or clapper weighs 18,600 pounds, or over 9¼ tons. The foundation was laid in 1450 A. D. Forty-three Popes lived and died during the time the work was in progress. It was dedicated in the year 1826, but not entirely finished until the year 1880. The cost, in round numbers, is set down as $70,000,000.

CAPITOL BUILDING at Washington, D. C., is the largest building in the United States. The corner stone was laid December 18, 1793, by President Washington, assisted by other Masons. It was partially destroyed by the British in 1814. The present dome was begun in 1855 and finished in 1863. The flag of the United States first floated from it December 12, 1863. The cost of the entire building has been something over $13,000,000. Its length is 715 feet 4 inches; width, 324 feet. It covers 3½ acres of ground. The distance from the ground to the top of the dome is 307½ feet; diameter of the dome, 135½ feet—making fifth as to size with the greatest domes of the world.



ST. PETER'S AND THE VATICAN, ROME.

LARGEST AND COSTLIEST PRIVATE MANSION in the world is that belonging to Lord Bute, called Montstuart, and situated near Rothesay, England. It covers nearly two acres; is built in gothic style; the walls, turrets and balconies are built of stone. The immense tower in the center of the building is 120 feet high, with a balcony around the top. The halls are constructed entirely of marble and alabaster,

and the rooms are finished in mahogany, rosewood and walnut. The fire-places are all carved marbles of antique design. The exact cost of this fairy palace is not known, but it has never been estimated at less than $8,000,000.

LARGEST BODY OF FRESH WATER in the world is Lake Superior. It is 400 miles long and 180 miles wide; its circumference, including the windings of its various bays, has been estimated at 1800 miles. Its area in square miles is 32,000, which is greater than the whole of New England, leaving out Maine. The greatest depth of this inland sea is 200 fathoms, or 1200 feet. Its average depth is about 160 fathoms. It is 636 feet above sea level.

FAMOUS CORLISS ENGINE, the largest ever constructed, and the one used to drive the machinery in the great hall at the Centennial of 1876, is now in the shops of the Pullman Car Company at Pullman, near Chicago, Ill. The writer is aware that this differs from other statements that have been made, it being generally supposed that the Emperor of Brazil bought the engine and removed it to his own country. He did talk of buying it, but the bargain was never consummated. This tireless giant works in an upright position, is over 40 feet high, of 1400 horse-power, and has two 40-inch cylinders and a 10-foot stroke.

LARGEST FERRY-BOAT ever constructed was named the Solano, and is now in use daily conveying trains across the Straits of Carquinez, between Benecia and Port Costa. The Solano is 460 feet long, 116 feet wide, and 20-foot depth of hold. She has 8 steel boilers, 4 rudders and a tonage of 3841 tons. On her decks are 4 railway tracks, with capacity for 48 ordinary freight cars and 2 locomotives, or 28 passenger coaches of the largest build.

HIGHEST BUILDING in the world, not counting the Eiffel Tower, the Washington Monument and the City Hall, Philadelphia, is the Cologne Cathedral. The height from the pavement to the top of the cupola is 511 feet. It is 511 feet long, exactly the same as the height, and 231 feet wide. It was begun August 15th in the year 1248, and was pronounced finished August 14, 1880, over 600 years after the corner-stone was laid.

HIGHEST MOUNTAIN on the globe is not, as is generally supposed, Mt. Everest, that honor belonging to a lofty peak named Mt. Hercules on the Isle of Papua, New Guinea, discovered by Capt. Lawson in 1881. According to Lawson, this monster is 32,763 feet in height, being 3781 feet higher than Mt. Everest, which is only 29,002 feet above the level of the Indian Ocean.

LARGEST STATE in our grand republic is Texas, which contains 274,356 square miles, capable of sustaining 20,000,000 of people, and then it would not be more crowded than Scotland is at present. It has been estimated that the entire population of the globe could be seated upon chairs within the boundary of Texas, and each have four feet of elbow room.

MISSISSIPPI RIVER, from the source of the Missouri to the Eads jetties, is the LONGEST RIVER in the world. It is 4300 miles in length and drains an area of 1,726,000 square miles. The Amazon, which is, without doubt, the widest river in the world, including the Beni, is 4000 miles in length and drains 2,330,000 square miles of territory.

LARGEST CUSTOM-HOUSE in this or any other land is in New Orleans. It was begun in 1848 and over thirty years elapsed before it was finished and ready for use. It is built of Quincy granite, the interior being finished in finest marble. It has 111 rooms; height from the pavement to the top of the cornice is 80 feet, and to the top of the light on the dome 187 feet. The dome itself is 49 feet square and 61 feet high; estimated total cost of building, $4,900,000.

LARGEST HOTEL in the United States, and probably the largest in the world, is located at San Francisco, Cal. It is 9 stories high and cost $3,500,000. It is named the Palace, and has accommodations for 1,500 guests.

FINEST THEATRE in the world is in Paris. It is of solid stone, finished with marble floors, and covers about four acres of ground. La Scala, of Milan, has the largest seating capacity, while the Auditorium at Chicago, completed in 1889, seating 7000 people, ranks second in that respect.

A BLOCK OF COAL exhibited at the Iowa State Fair is thought to be the largest even mined; it weighed 7000 pounds.

LARGEST BOUND BOOK ever made is owned by Queen Victoria. It is 18 inches thick and weighs 63 pounds. It contains the jubilee addresses of congratulation.

LARGEST COAL BREAKER in the world is in operation at Edwardsville Colliery, Luzerne County, Pa. It prepares for market 4000 mine cars of coal every ten hours.

GREATEST ELEVATION ever attained by balloonists was 37,000 feet—about 7 miles. The aeronauts were James Glaisher, F. R. S., and Mr. Coxwell. The ascent was made September 5, 1862, at Wolverhampton, England.

LONGEST SINGLE SPAN OF WIRE in the world is used for a telegraph in India. It is stretched over the River Kistuah, between Bezorah and Sectauagrum. It is over 6000 feet long, and is stretched from the top of one mountain to the top of another, each mountain being nearly 2000 feet high.

TWO LARGEST CASTINGS in the world are in Japan, one at Nara and the other at Kamakura. Both are statues. The one at Nara is 53 feet and 9 inches from the base to the crown of the head. It was first cast in the eighth century, but was afterward destroyed and recast in the year 1223. The Kamakura statue is 47 feet high.

SYDNEY (Australia) LIGHTHOUSE is provided with the largest electric light in the world. It has a power of 180,000 candles and may be seen from ships 50 miles at sea. The next largest is in the Palais d'Industrie and has a power of 150,000 candles. San Jose, California, has the most powerful electric light in the United States, one of 24,000 candle power.

STONE PAVEMENT in front of the residence of the late William H. Vanderbilt, in New York City, is made up of the largest slabs of flagging stone ever put in a single pavement. The stones were taken from quarries in Pike County, Pennsylvania, west of Port Jervis, N. Y., and from the Bigelow quarries in Ulster County, N. Y. The large slab immediately in front of the residence is the largest slab of its kind ever transported from any quarry and cost the millionaire $9200; the entire cost of the pavement was $47,000.

GREATEST INDIVIDUAL LAND PROPRIETOR in the world is Wilson Waddingham, who in 1887 purchased 163,000 acres of land in San Miguel County, New Mexico. His present landed interests amount to 1,500,000 acres, about 500,000 acres more than are claimed for the Duke of Westminster. In 1896 the largest producing farm in the world was one of the same number of acres (1,500,000) situated in the sonthwest corner of Louisiana. This immense farm is operated by a northern syndicate, with J. B. Watkins as manager.

GREATEST FORTRESS, from a strategical point of view, is the famous stronghold of Gibraltar. It occupies a rocky peninsula jutting out into the sea, about three miles long and three-quarters of a mile wide. One central rock rises to a height of 1435 feet above the sea-level. Its northern face is almost perpendicular, while its east side is full of tremendous precipices. On the south it terminates in what is called Europa Point. The west side is less steep than the east, and between its base and the sea is the narrow, almost level span on which the town of Gibraltar is built. The fortress is considered impregnable to military assault. The regular garrison in time of peace numbers about 7000.

BIGGEST CAVERN is the Mammoth Cave, in Edmonson County, Kentucky. It is near Green River, about six miles from Cave City, and twenty-eight from Bowling Green. The cave consists of a succession of irregular chambers, some of which are large, situated on different levels. Some of these are traversed by the navigable branches of the subterranean Echo River. Blind fish are found in its waters.

LARGEST HANGING BELL IN THE WORLD is in a Buddhist monastery, near Canton, China. It is eighteen feet high and forty-five feet in circumference, and is of solid bronze. It is one of the eight great bells which were cast by command of the Emperor Yung-lo about A. D. 1400, and is said to have cost the lives of eight men, who were killed during the process of casting. The whole bell, both inside and out, is covered with an inscription in embossed Chinese characters about half an inch long, covering even the handle, the total number being 84,000. The characters tell a single story—one of the Chinese classics.

LARGEST STATIONERY ENGINE IN THE WORLD is at the famous zinc mines at Friedensville, Pa. It is known as the "President," and there is no pumping engine in the world that can be compared with the monster. The number of gallons of water raised every minute is 17,500. The driving wheels are thirty-five feet in diameter and weigh forty tons each. The sweep rod is forty feet long, the cylinder 110 inches in diameter, and a piston-rod eighteen inches in diameter, with a ten-foot stroke.

LARGEST GUN IN THE UNITED STATES is the 20-inch Rodman, smooth bore, at Fort Hamilton, New York Harbor. Its dimensions are as follows: Extreme length, 243⅝ inches; maximum diameter, 64 inches; minimum diameter, 34 inches; length of bore in calibers, 10.50 inches. The service charge is 200 pounds of powder, and the weight of the projectile is 2000 pounds. There is also a wrought iron lined rifled 12½ inch gun at Sandy Hook. Its weight is 89,350 pounds; extreme length, 262⅔ inches; maximum diameter, 55 inches; minimum diameter, 27.55 inches; length of the bore in calibers, 18.53 inches. The gun is used for experimental purposes in testing powder.

The Longest Tunnels in the World.

MOUNT ST. GOTHARD TUNNEL, Italy, is 48,840 feet long, or nearly ten miles long, and the longest in the world.

MOUNT CENIS TUNNEL, Italy, is 39,840 feet long, or about seven miles long.

HOOSAC TUNNEL, Massachusetts, is 25,031 feet long, or about four and one-half miles.

NOCHISTONGO TUNNEL is 21,659 feet long or about four miles.

SUTRO TUNNEL is 20,028 feet long, or four miles.

THAMES AND MEDWAY, England, is 11,880 feet long, or about two miles.



LARGEST PILLARS IN THE WORLD—RUINS OF KARNAK, EGYPT. 347

Largest Steam Hammer in the World.

The greatest steam hammer in the world, constructed at the Bethlehem Iron Company's works for the manufacture of armor plate, was designed after the hammer of Schneider & Co., of Le Crusot, France, which, next to this one, is the largest hammer in the world. It has a stroke of 125 tons, while the Schneider hammer is only capable of striking a 100-ton blow. The hammer is used for forging ingots into armor plates. These ingots are cast of metal weighing from 100 to 150 tons, and by this stupendous piece of mechanism are forged into the desired sizes by 125-ton blows.

The hammer stands in the centre of a very large building and over a year was spent in its construction. A pit 58 by 62 feet was dug for the foundation and on walls 30 feet high the anvil stands. To give the foundation a certain elasticity a layer of 20 steel slabs on top of Ohio white oak timbers was made and the surface was rendered perfectly smooth. It was of course entirely out of the question to cast in a single piece the iron required and the anvil was built by depositing on top of the steel slabs and their timbers 22 blocks of solid cast iron. The average weight of these blocks is 70 tons, and the entire weight of the mass of iron and steel forming the anvil and foundation is nearly 1800 tons.

The hammer itself is a majestic looking structure, superimposed over the cyclopean mass of iron, forming the anvil—huge, substantial and powerful, rising to a height of 90 feet.

Most Notable Bridges of the World.

BROOKLYN BRIDGE was Commenced, under the direction of J. Roebling, in 1870, and completed in about thirteen years. The cost of building was nearly $15,000,000. (The dimensions are given elsewhere.)

CANTILEVER BRIDGE, over the Niagara, is built almost entirely of steel. Its length is 910 feet, the total weight is 3000 tons, and the cost was $900,000.

FIRST NIAGARA SUSPENSION BRIDGE was built by Roebling in 1852–53, at a cost of $400,000. It is 245 feet above water, 821 feet long, and the strength is estimated at 1200 tons.

BRIDGE AT HAVRE DE GRACE, over the Susquehanna, is 3271 feet long, and is divided into twelve wooden spans, resting on granite piers.

BRITANNIA BRIDGE crosses the Menai strait, Wales, at an elevation of 103 feet above high water. It is of wrought iron, 1511 feet long, and was finished in 1850. Cost, $3,008,000.

NEW LONDON BRIDGE is constructed of granite, from the designs of L. Rennier. It was commenced in 1824, and completed in about seven years, at a cost of $7,291,000.

OLD LONDON BRIDGE was the first stone bridge. It was commenced in 1176 and completed in 1209. Its founder, Peter of Colechurch, was buried in the crypt of the chapel erected on the centre pier.

COALBROOKDALE BRIDGE, England, is the first cast-iron bridge. It was built over the Severn in 1779.

BRIDGE AT BURTON, over the Trent, was formerly the longest bridge in England, being 1545 feet. It is now partly removed. Built in the twelfth century.

THE RIALTO, at Venice, is said to have been built from the designs of Michael Angelo. It is a single marble arch, 98½ feet long, and was completed in 1591.

BRIDGE OF SIGHS, at Venice, over which condemned prisoners were transported from the hall of judgment to the place of execution, was built in 1589.

BRIDGE OF THE HOLY TRINITY, at Florence, was built in 1569. It is 322 feet long, constructed of white marble, and stands unrivaled as a work of art.

COVERED BRIDGE AT PAVIA, over the Ticino, was built in the fourteenth century. The roof is held by 100 granite columns.

ST. LOUIS BRIDGE, over the Mississippi, is 1524 feet long, exclusive of approaches. There are three arched spans of cast steel, the centre arch being 520 feet, with a rise of 47½ feet; and the side spans 502 feet each, with a rise of 46 feet. The width on top, between rails, is 50 feet. The piers rest on the bedrock of the river, 136 feet below high water mark. Captain James B. Eads was the engineer.

RUSH STREET BRIDGE, Chicago, Ill., erected in 1884, at a cost of $132,000 is the largest general traffic drawbridge in the world. Its roadway will accomdate four teams abreast, and its footways are seven feet wide.

VICTORIA BRIDGE, Montreal, one of the most famous in the world, is nearly two miles in length.

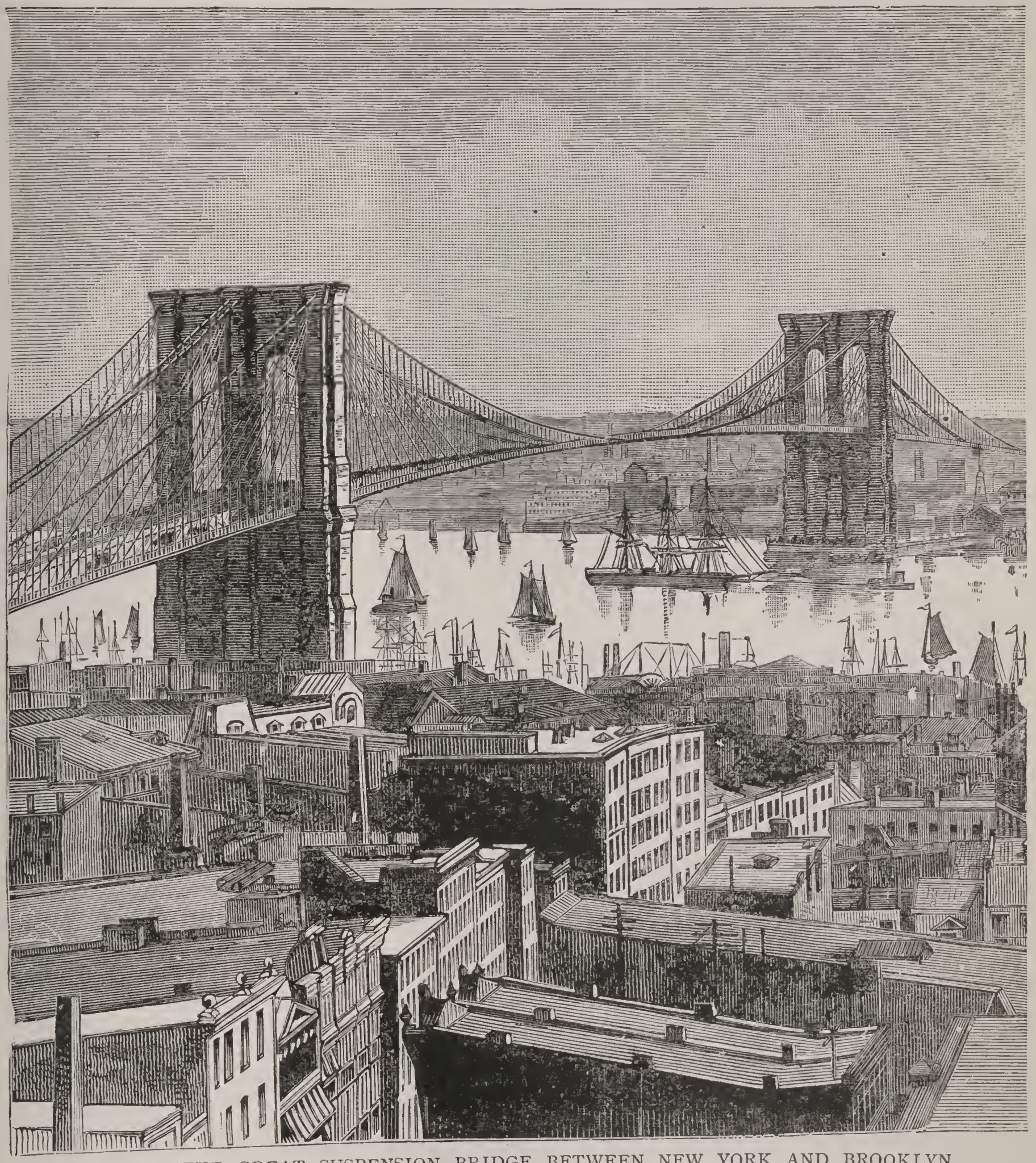
CLEVELAND (O.) VIADUCT is 3211 feet in length, 64 feet wide, 42 feet of which is roadway; the drawbridge is 332 feet in length, 46 feet wide, and is 68 feet above ordinary stage of water.

The Greatest City in the World.

London, England, is the greatest city the world ever saw. It covers within the fifteen miles radius of Charing Cross (Strand) 700 miles. It numbers within these boundaries 5,656,000 of inhabitants. It comprises over 2,000,000 foreigners from every quarter of the globe. It contains more Roman Catholics than Rome itself; more Jews than the

whole of Palestine; more Irish than Dublin; more Scotchmen than Edinburgh; more Welshmen than Cardiff; more country-raised persons than the counties of Devon, Warwickshire and Durham combined.

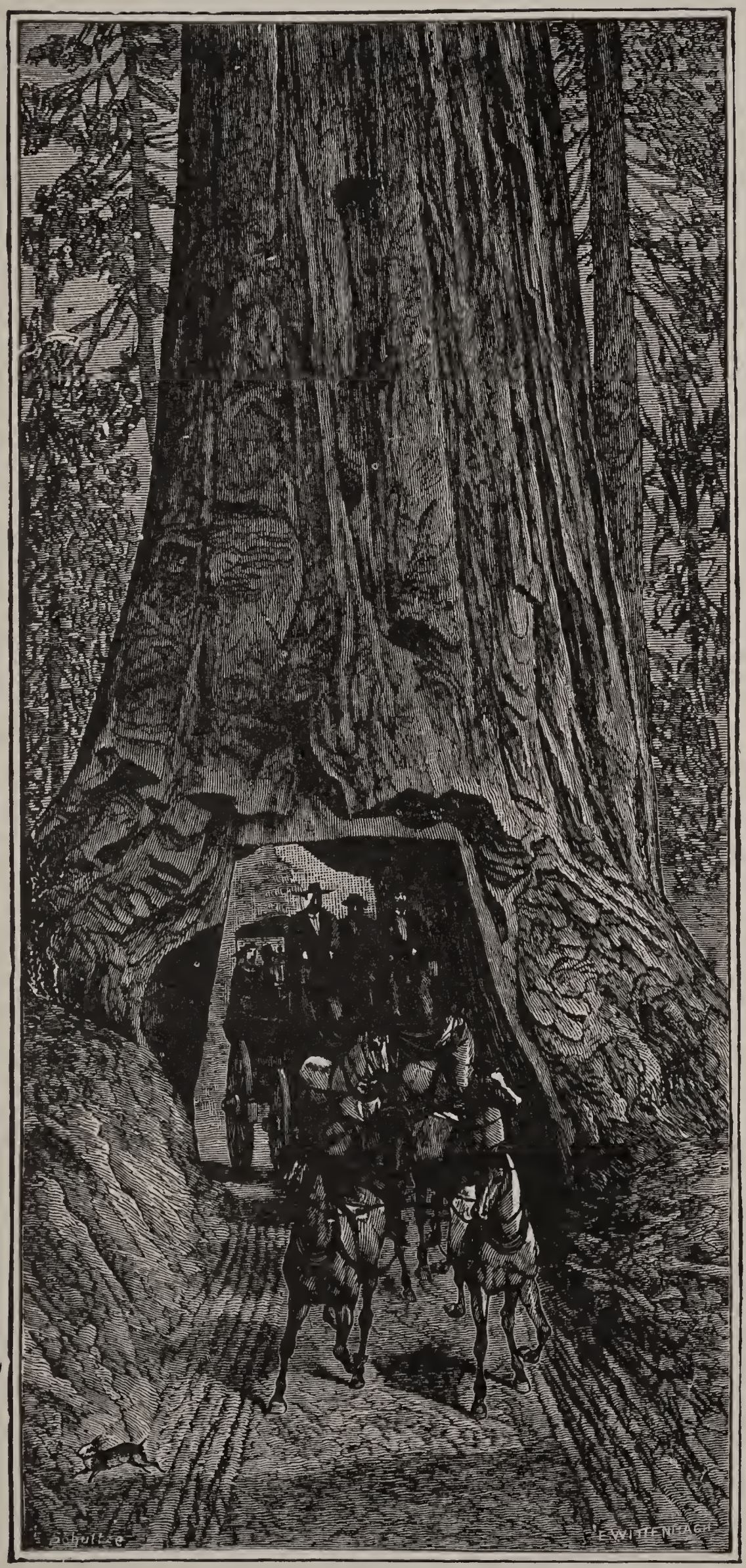
London has 49,000 persons added annually (by birth) to its population; has over 1000 ships and 10,000 sailors in its port every day; has as many beer shops and gin palaces as would, if placed side



THE GREAT SUSPENSION BRIDGE BETWEEN NEW YORK AND BROOKLYN.

Has a birth every five minutes, has a death in it every eight minutes; has seven accidents every day in its 8000 miles of streets; has on an average 40 miles of streets opened and 15,000 new houses built in every year.

by side, stretch from Charing Cross to Portsmouth, a distance of seventy-eight miles; has 38,000 drunkards annually brought before its magistrates; has seventy miles of open shops every Sunday; has influence with all parts of the world represented by



ONE OF THE BIG TREES OF CALIFORNIA.

a yearly delivery in its postal districts of 298,000,000 of letters. Eight hundred and fifty trains pass Clapham junction every day, and the transportation (underground) railroad runs 1211 trains every day.

The London Omnibus Company have over 700 'busses, which carry 56,000,000 passengers annually. It is more dangerous to walk the streets of London than to travel by railroad or to cross the Atlantic from New York to Liverpool. In 1886, 130 persons were killed and 2000 injured by vehicles in the streets. There are in London 15,000 police, 15,000 cabmen, 15,000 persons connected with the post-office. The cost of gas for lighting London annually is $3,000,000. London has 400 daily and weekly newspapers. The ancient city of London was first founded by Brute, the Trojan, in the year of the world 2832, so that since the first building it is 3007 years old. The drainage system of London is superb, and the death rate very low.

The Largest Trees in the World.

The big trees of Calaveras and Mariposa Counties, in California, belong to the same genus as the common redwood. This giant of the Sierras is not a handsome tree, either when young or aged; the branches are short, the spray less graceful than the coast redwood, the leaves small and awl-shaped, but the cones are several times larger, and the wood is of a duller reddish hue. The forests were first seen by white men in the spring of 1852, when a hunter named Dowd conducted a party of miners to the locality where the big trees grew. In the several groves where they have been found, there are many trees from 275 to 335 feet high, and from 25 to 34 feet in diameter. The area of Mariposa Grove is two miles square, and it contains 427 of the monster trees.

The largest in the Calaveras Grove is "The Keystone State," and is 325 feet high, and its girth six feet from the ground is 45 feet. There are some in the Mariposa Grove which are not so high, but which have a greater circum-

ference. "The Grizzly Gian," for example, being 93 feet at the ground, and over 64, eleven feet above. Some dozen miles south of the Mariposa Grove is the Fresno Grove, which is said to contain about 600 trees, the largest 81 feet in circumference; while about fifty miles north of the Calaveras, in Placer county, a small grove has been discovered. Careful computations have been made of the ages of these trees, and some cautious scientists admit, in regard to one of them, that "its age cannot have exceeded 1300 years!"

The Largest Park in the World.

The Yellowstone National Park extends sixty-five miles north and south and fifty-five miles east and west, comprising 3575 square miles, and is 6000 feet or more above sea level. Yellowstone Lake, twenty miles by fifteen, has an altitude of 7788 feet. The mountain ranges which hem in the valleys on every side rise to the height of 10,000 to 12,000 feet, and are always covered with snow. This great park contains the most striking of all the mountains, gorges, falls, rivers and lakes in the whole Yellowstone region.

The springs on Gardiner's River cover an area of about one square mile, and three or four square miles thereabout are occupied by the remains of springs which have ceased to flow. The natural basins into which these springs flow are from four to six feet in diameter and from one to four feet in depth. The principal ones are located upon terraces midway up the sides of the mountain. The banks of the Yellowstone River abound with ravines and canyons, which are carved out of the heart of the mountains through the hardest rocks.

The most remarkable of these is the canyon of Tower Creek and Column Mountain. The latter, which extends along the eastern bank of the river for upward of two miles, is said to resemble the Giant's Causeway. The canyon of Tower Creek is about ten miles in length, and is so deep and gloomy that it is called "The Devil's Den." Where Tower Creek ends the Grand Canyon begins. It is twenty miles in length, impassable throughout, and inaccessible at the water's edge, except at a few points. Its rugged edges are from 200 to 500 yards apart, and its depth is so profound that no sound ever reaches the ear from the bottom.

The Grand Canyon contains a great multitude of hot springs of sulphur, sulphate of copper, alum, etc. In the number and magnitude of its hot springs and geysers, the Yellowstone Park surpasses all the rest of the world. There are probably fifty geysers that throw a column of water to the height of from 50 to 200 feet, and it is stated that there are not fewer than 5000 springs.

The temperature of the calcareous springs is from 160 to 170 degrees, while that of the others rises to 200 or more. The principal collections are the upper and lower geyser basins of the Madison River and the calcareous springs on Gardiner's River. The great falls are marvels to which adventurous travelers have gone only to return and report that they are parts of the wonders of this new American wonderland.

The Washington Monument.

The corner-stone was laid by President Polk, July 4, 1848, and December 6, 1884, the cap-stone was set in position. The foundations are 126½ feet square and 36 feet 8 inches deep. The base of the monument is 55 feet 1½ inches square, and the walls 15 feet ¼ inch thick. At the 500-foot mark, where the pyramidal top begins, the shaft is 34 feet 5½ inches square and the walls are 18 inches thick.

The monument is made of blocks of marble 2 feet thick, and it is said there are over 18,000 of them. The height above the ground is 555 feet. The pyramidal top terminates in an aluminum tip, which is 9 inches high and weighs 100 ounces. The mean pressure of the monument is 5 tons per square foot, and the total weight, foundation and all, is nearly 81,000 tons. The door at the base, facing the capitol, is 8 feet wide and 16 feet high, and enters a room 25 feet square.

An immense iron frame-work supports the machinery of the elevator, which is hoisted with steel wire ropes, 2 inches thick. At one side begin the stairs, of which there are 50 flights, containing 18 steps each. Five hundred and twenty feet from the base there are 8 windows, 18x24 inches, 2 on each face. The area at the base of the pyramidal top is 1187¼ feet, space enough for a six-room house, each room to be 12x16 feet. The Cologne Cathedral is 511 feet high; the pyramid of Cheops, 486; Strasburg Cathedral, 474; St. Peter's at Rome, 448; the Capitol at Washington, 306, and Bunker Hill Monument, 221 feet. The Washington Monument, therefore, is the highest structure in the world, except the temporary Eiffel Tower. The total cost was not far from $1,500,000.

Height of Principal Monuments and Buildings.

Places.	Names.	Feet.
Paris	Eiffel	1000
Wash., D. C	Washington Monument	555
Philadelphia	Public Buildings	545
Egypt	Pyramid of Cheops	486
Belgium	Antwerp Cathedral	476
France	Strasburg Cathedral	474
Egypt	Pyramid of Cephrenes	456
Rome	St. Peter's Church	448

Places.	Names.	Feet.
Germany	St. Martin's Church at Landshut.	411
England	Salisbury Cathedral	400
England	St. Paul's Church, London	365
Italy	Cathedral at Florence	386
Lombardy	Cathedral at Cremona	397
Germany	Church at Fribourg	386
Spain	Cathedral of Seville	360
Lombardy	Cathedral of Milan	355
Holland	Cathedral of Utrecht	356
New York	Trinity Church	284
China	Porcelain Tower, Nankin	260
Paris	Church of Notre Dame	224
Massachusetts.	Bunker Hill Monument	221
Italy	Leaning Tower of Pisa	179
Baltimore	Washington Monument	175
Paris	Monument, Place Vendome	153
Italy	Trojan's Pillar, Rome	151
Paris	Obelisk of Luxor	110

Capacity of the Largest Churches and Hall

St. Peter's Cathedral	Rome	54,000
Cathedral of Milan	Milan	37,000
St. Paul's Church	Rome	32,000
St. Paul's Cathedral	London	25,000
Church of St. Petronio.	Bologna	24,000
Cathedral of Florence	Florence	24,000
Cathedral of Antwerp	Antwerp	24,000
Mosque of St. Sophia	Constantinople	23,000
St. John's Lateran	Rome	22,000
Cathedral of Notre Dame	Paris	21,000
Cathedral of Pisa	Pisa	13,000
Church of St. Stephen.	Vienna	12,000
Church of St. Dominic.	Bologna	12,000
Church of St. Peter	Bologna	11,400
Cathedral of Vienna	Vienna	11,000
St. Peter's Cathedral	Montreal	10,000
Auditorium	Chicago	8,000

The Highest Mountains.

	Feet.
Kunchainyunga, Himalayas	28,170
Sorata, Andes	25,380
Illimani, Bolivia	21,780
Chimborazo, Ecuador	21,444
Hindoo-Koosh, Afghanistan	20,600
Cotopaxi, Ecuador	19,408
Antisana, Ecuador	19,150
St. Elias, British America	18,000
Popocatapetl, Mexico	17,735
Mt. Roa, Hawaii	16,000
Mt. Brown	15,900
Mont Blac	15,776
Mowna Roas, Owhyhee	15,700
Mt. Rosa, Alps, Sardinia	15,550
Pinchinca, Ecuador	15,200
Mt. Whitney, California	15,000
Mt. Fairweather, Alaska	14,796
Mt. Shasta, California	14,450
Pike's Peak, Colorado	14,320
Mt. Ophir, Sumatra	13,800
Fremont's Peak, Wyoming	13,570
Long's Peak, California	13,400
Mt. Ranier, Washington	13,000
Mt. Ararat, Armenia	12,700
Peak of Teneriffe, Canaries	12,236
Miltsin, Morocco	12,000
Mt. Hood, Oregon	11,570
Simplon, Alps	11,542
Mt. Lebanon, Syria	11,000
Mt. Perdu, France	10,950
Mt. St. Helen's, Oregon	10,158
Mt. Etna, Sicily	10,050
Olympus, Greece	9,754
St. Gothard, Alps	9,080
Mt. Sinai, Arabia	8,000
Pindus, Greece	7,677
Black Mountain, New Caledonia	6,467
Mt. Washington, New Hampshire	6,234
Mt. Marcy, New York	5,467
Mt. Hecla, Iceland	5,000
Ben Nevis, Scotland	4,400
Mansfield, Vermont	4,2[illegible]
Peaks of Otter, Virginia	4,260
Ben Lawers, Scotland	4,030
Parnassus, Greece	3,850
Vesuvius, Naples	3,93[illegible]
Ben Lomond, Scotland	3,280
Mt. Carmel	2,000

Height of Twenty-four of the Loftiest Volcanoes of the World.

Name of Volcano.	Height in feet.	Where Located
Sahama	23,000	Peru.
Llullaillac	21,000	Chili.
Arequipa	20,500	Peru.
Cayambi	19,813	Equador.
Cotopaxi	19,500	Peru.
Antisana	19,200	Ecuador.
San Jose	18,150	Chili.
Mt. St. Elias	17,900	Alaska.
Popocatepetl	17,884	Mexico.
Orizaba	17,370	Mexico.
Altar	17,126	Ecuador.
Sangai	17,120	Ecuador.
Klintcheoskaia	16,512	Kamtschatka
Iztacihuate	15,700	Mexico.
Toluco	15,500	Mexico.
Shasta	14,400	United States

Name of Volcano.	Height in feet.	Where Located.
Fujiyama	14,000	Japan.
Mauna Kea	13,953	Sandwich Islands.
Mauna Loa	13,760	Sandwich Islands.
Teneriffe	12,236	Canary Islands.
Mt. St. Helens	12,000	United States.
Mt. Hood	11,225	United States.
Peak of Tahiti	10,895	Friendly Islands.
Mt. Etna	10,874	Sicily.

Three of the best known volcanoes of the world, Vesuvius, 3978 feet; Hecla, 3970 feet, and Stromboli, 3000 feet, are of much less elevation than many others altogether unfamiliar.

Greatest Known Depth of the Ocean.

The greatest depth which has been ascertained by sounding is five miles and a quarter (25,720 feet, or 4620 fathoms), not quite equal to the height of the highest known mountain. The average depth between 60 degrees north and 60 degrees south is nearly three miles.

Deepest Lake in the World.

In the Cascade Mountains, about seventy-five miles northeast of Jacksonville, Ore., the seeker for the curious will find the Great Sunken Lake, the deepest lake in the world. This lake rivals the famous valley of Sinbad the Sailor. It is said to average 2000 feet down to the water on all its sides. The depth of the water is unknown, and its surface is as smooth and unruffled as a mammoth sheet of glass, it being so far below the mountain rim as to be unaffected by the strongest winds. It is about 15 miles in length and about 4½ wide.

For unknown ages it has lain still, silent and mysterious in the bosom of the great mountain range, like a gigantic trench scooped out by the hands of a giant genie. A hunting and surveying party recently left Jacksonville with the intention of ascertaining the exact depth of this mysterious body of water, and to find out, if possible, whether or not fish are to be found within its ghostly precincts.

The Longest Rivers in the World.

Name.	Miles.
EUROPE.	
Volga, Russia	2,500
Danube	1,800
Rhine	840
Vistula	700
ASIA.	
Yeneisy and Selenga	3,580
Kiang	3,290
Hoang Ho	3,040
Amoor	2,500
Euphrates	1,900
Ganges	1,850
Tigris	1,160
AFRICA.	
Nile	3,240
Niger	2,400
Gambia	1,000
SOUTH AMERICA.	
Amazon and Beni	4,000
Platte	2,700
Rio Madeira	2,300
Rio Negro	1,650
Orinoco	1,600
Uruguay	1,100
Magdalena	1,000
NORTH AMERICA.	
Mississippi and Missouri	4,300
Mackenzie	2,800
Rio Bravo	2,300
Arkansas	2,070
Red River	1,520
Ohio and Allegheny	1,480
St. Lawrence	1,450

Size of Lakes, Seas and Oceans

Lakes.	Miles Long.	Miles Wide.
Superior	380	120
Michigan	330	60
Ontario	180	40
Champlain	123	12
Erie	270	50
Huron	250	90
Cayuga	36	4
George	36	3
Baikal	360	35
Great Slave	300	45
Winnipeg	240	40
Athabasca	200	20
Maracaybo	150	60
Great Bear	150	40
Ladoga	125	75
Constance	45	10
Geneva	50	10
Lake of the Woods	70	25

Seas.	Miles Long.
Mediterranean	2,000
Carribbean	1,800
China	1,700
Red	1,400
Japan	1,000
Black	932

Seas.	Miles Long.
Caspian	640
Baltic	600
Okhotsk	600
White	450
Aral	250

Oceans.	Miles Square.
Pacific	80,000,000
Atlantic	40,000,000
Indian	20,000,000
Southern	10,000,000
Arctic	5,000,000

The Greatest Catastrophes of History.

In China, where some of the greatest rivers in the world flow between artificial banks at an elevation considerably above the surrounding country, there have been overflows that caused the destruction of hundreds of thousands of lives. There have been similar disasters in India, where, as in China, the rivers had made beds for themselves with alluvial banks higher than the plains across which they flowed. But aside from these the colossal calamity at Johnstown, Pa., in June, 1889, and through the fated Conemaugh Valley, leads all disasters in this country in the appalling muster roll of the dead, numbering over 6000. In past centuries the greatest loss of life has been by earthquake, and the following list embraces the loss in historic calamities :

Year.	Place.	Persons Killed.
1137	Sicily	15,000
1158	Syria	20,000
1268	Cilicia	50,000
1456	Naples	40,000
1531	Lisbon	40,000
1626	Naples	70,000
1667	Schamaki	80,000
1692	Jamaica	4,000
1693	Sicily	100,000
1703	Aquila, Italy	4,000
1703	Yeddo, Japan	200,000
1706	The Abruzzi	15,000
1716	Algiers	20,000
1726	Palermo	6,000
1731	Pekin	100,000
1746	Lima and Calloa	18,000
1754	Grand Cairo	40,000
1755	Kashan, Persia	40,000
1759	Syria	20,000
1784	Ezinghian, Asia Minor	5,000
1792	Country between Santa Fé and Panama	40,000
1805	Naples	6,500
1822	Aleppo	20,000
1829	Murcia	5,000
1830	Canton	6,000
1842	CapeHaytien	4,000
1857	Calabria	10,000
1859	Quito	5,000
1860	Mendozi, South America	7,000
1868	Towns in Peru and Ecuador	25,000
1875	San Jose de Cucuta, Colombia	14,000
1881	Scio	4,000
1886	Charleston	96

One instance shows how the human race has been depleted from this cause. In the Kingdom of Naples, from 1783 to 1857, a period of 75 years, the loss of life by earthquakes was 111,000 or at the rate of more than 1500 a year, out of a population of 6,000,000. The country surrounding the Mediterranean and the intertropical area from which the American Cordilleras spring, may be regarded as the centers of earthquake activity, though some of the greatest earthquakes of all time have occurred in Eastern Asia and the East Indies.

Floods and Freshets.

The list of losses by great floods and freshets in history is as follows :

Year.	Place.	Lives Lost.	Year.	Place.	Lives Lost
1871	China	3,000	1887	Yellow River China	100,000
1874	Mill River Mass	150	1889	Johnstown, Pa	6,111
1879	Marcia, Spain	1,000	1900	Galveston, Texas	5,000

Greatest Conflagrations of the Present Century.

But the greatest destruction of life and property by conflagrations, of which the world has anything like accurate records, must be looked for within the current century. Of these the following is a partial list of instances in which the loss of property amounted to $3,000,000 and upward :

Dates.	Cities.	Property Destroyed
1802	Liverpool	$ 5,000,000
1805	St. Thomas	30,000,000
1812	Moscow, burned five days ; 30,800 houses destroyed	150,000,000
1820	Savannah	4,000,000
1822	Canton, nearly destroyed	
1835	New York ("Great Fire")	15,000,000
1837	St. John, N. B.	5,000,000
1838	Charleston, 1158 buildings	3,000,000
1842	Hamburg, 4219 buildings, 100 lives lost	35,000,000
1845	New York, 35 persons killed	7,000,000
1845	Pittsburgh, 1100 buildings	10,000,000
1845	Quebec, May 28, 1650 dwellings	3,750,000
1846	St. Johns, Newfoundland	5.000,000
1848	Constantinople, 2500 buildings	15,000,000
1848	Albany, N. Y., 600 houses	3,000,000
1849	St. Louis.	3,000,000
1851	St. Louis, 2500 buildings	11,000,000
1751	St. Louis, 500 buildings	3,000,000
1851	San Prancisco, May 4 and 5, many lives lost	10,000,000
1851	San Francisco, June	3,000,000
1852	Montreal, 1200 buildings	5,000,000
1862	St. Petersburg	5,000,000

Dates.	Cities.	Property Destroyed.
1862	Troy, N. Y., nearly destroyed.....	
1865	Constantinople, 2800 buildings burned.....	
1866	Yokohama, nearly destroyed.....	
1865	Carlstadt, Sweden, all consumed but Bishop's residence, hospital, and jail; 10 lives lost.....	
1866	Portland, Me., half the city.....	$11,000,000
1866	Quebec, 2500 dwellings and 17 churches.....	
1870	Constantinople, Pera suburb.....	26,000,000
1871	Chicago, 250 lives lost, 17,430 buildings burned, on 2124 acres.....	192,000,000
1871	Paris, fired by the Commune.....	160,000,000
1872	Boston.....	75,000,000
1877	Pittsburgh, caused by riot.....	3,260,000
1877	St. Johns, N. B., 1650 dwellings, 18 lives lost.....	12,500,000
1889	Seattle, Wash.....	20,000,000

From the above it appears that the greatest fires on record, reckoned by destruction of property, are :

Chicago fire, of Oct. 8 and 9, 1871.....	$192,000,000
Paris fires, of May, 1871.....	160,000,000
Moscow fire, of Sept. 14–19, 1812.....	150,000,000
Boston fire, Nov. 9–10, 1872.....	75,000,000
Hamburg fire, May 5–7, 1842.....	35,000,000

Taking into account, with the fires of Paris and Chicago, the great Wisconsin and Michigan forest fires of 1871, in which it is estimated that 1000 human beings perished and property to the amount of over $3,000,000 was consumed, it is plain that in the annals of conflagrations that year stands forth in gloomy pre-eminence.

Chicago's Great Fires.

There were 2100 acres of land burned over, nearly all of which area was thickly covered with buildings. There were nearly 18,000 buildings destroyed, of which about 2400 were stores and factories; and there were but few short of 100,000 people rendered homeless by the calamity. The extreme length of the burnt district was 3¾ miles, and its greatest width a little over a mile. The fire of July, 1874, originated on South Clark street, between Taylor and Twelfth, and spread northeast to Michigan avenue. It was estimated that in this fire about fifty acres were burned over, many of the new buildings which had been erected after the great fire of 1871 having been leveled.

The loss of property in the great fire of 1871 was $192,000,000, after allowing $4,000,000 for salvage on foundations of buildings. This estimate does not include the shrinkage of real estate values, or the large loss to mercantile interests by the interruption of trade consequent upon the destruction of stocks and business facilities. Mr. Colbert estimated the grand aggregate not very much below $290,000,000.

The loss occasioned by the fire of 1874 was estimated as follows : The net loss to insurance companies was officially placed at $2,244,970, or 40 per cent. of the entire loss, making an estimated total loss of $5,612,425. The cash contributions to Chicago within three months after the fire amounted to $4,200,000.

Most Noted Facts in Turf History.

The richest stake ever run in America was the Futurity stake of 1890, run at Sheephead Bay, L. I., August 30, and won by August Belmont's ch. c. Potomac (2) by St. Blaise, dam Susquehanna, by Leamington. The value of the stake was $77,700, of which $68,450 went to the winner, and $4500 to the second horse, Masher, b. c., by Ill Used also owned by Mr. Belmont, who in addition received $2500 for breeding first and second, making his winnings $75,450. Stathmeath, the third horse, received $2250.

The Lancashire plate run at the Manchester, Eng., September meeting of 1889, and won by the Duke of Portland's b. c. Donovan, was worth nearly $80,000 to the winner.

Largest amount ever won by an American two-year-old, $78,650, Potomac, b. c., by St. Blaise, 1890.

The greatest winning three-year-old was Hanover, by Hindoo. He won twenty races and $89,827.

Miss Woodford, br. m., foaled 1880, by imported Billet, dam Fanny Jane, by Neil Robinson, won more money than any animal that ever ran on the American turf, winning in five years forty-eight races, worth $118,970.

In 1886 the stable of Dwyer Brothers won $208,549.16 in purses and stakes—more money than was ever won by any other single racing establishment in America.

The greatest sale of thoroughbreds ever had in this country was that of P. Lorillard in 1886, at which twenty-seven head sold for $149,050, the highest price being $29,000, the lowest $300.

King Thomas, by King Ban, was the highest priced yearling ever sold at auction, L. O. Appleby paying $38,000 for him at the Haggin sale in New York, June 25, 1888. The following day Mr. Appleby sold the colt to Senator Hearst, of California, for $40,000.

Highest price ever paid for a horse, $105,000, for Axtell, br. s., record, 2.12, three years old, by William L. (son of George Wilkes), dam Lou, by Mam-

brino Boy. Purchased from C. W. Williams, of Independence, Iowa, by John W. Conley, of Chicago, and others.

Dimensions of Bartholdi's Statue of Liberty.

The figure of this statue, which is made of repousse, or hammered work—that is, thin sheets of copper beaten into shape and fastened about an iron skeleton—is 110½ feet high and weighs 100,000 pounds. The uplifted torch, however, is raised 26 feet, and adding to this the pedestal, the tip of the torch is raised 220 feet from the ground. The pedestal is of stone, 82 feet high. Some idea of the enormous proportions of the statue may be given from the fact that the forefinger is 8 feet long, and 4 feet in circumference at the second joint. The head is 14 feet high and 40 persons can stand in it.

The Dimensions of the Great Wall of China, and of What it is Built.

It runs from a point on the Gulf of Liantung, an arm of the Gulf of Pechili in Northeastern China, westerly to the Yellow River, thence makes a great bend to the south for nearly 100 miles, and then runs to the northwest for several hundred miles to the Desert of Gobi. Its length is 1250 miles. For the most of this distance it runs through a mountainous country, keeping on the ridges, and winding over many of the highest peaks. In some places it is only a formidable rampart, but most of the way it is composed of lofty walls of masonry and concrete, or impacted lime and clay, 25 feet in thickness, and 25 feet in height.

The top of this wall is paved for hundreds of miles, and crowned with crenelated battlements, and towers 30 to 40 feet high. In numerous places the wall climbs such steep declivities that its top ascends from height to height in flights of granite steps. An army could march on the top of the wall for weeks and even months, moving in some places ten men abreast.

Most Northern Point Reached by Arctic Explorers.

The following table shows the furthest points of north latitude reached by Arctic explorers up to and including the Greely expedition:

Year.	Explorers.	North Latitudes.		
1607	Hudson	80d	23m	00s
1773	Phipps (Lord Musgrove)	80d	48m	00s
1806	Scoresby	81d	12m	42s
1827	Parry	82d	45m	30s
1874	Meyer (on land)	82d	09m	00s
1875	Markham (Nare's expedition)	83d	20m	26s
1876	Payer	83d	07m	00s
1884	Lockwood (Greely's party)	83d	24m	00s

The distance from the farthest point of polar discovery to the pole itself is 6 deg. 46 min., or in round numbers, 460 miles. It is 30 miles less than from Chicago to Omaha, by the lines of the Chicago, Milwaukee and St. Paul railway, over which the traveller rides in 24 hours. But this polar radius, though only 460 miles in extent, is covered by ice gorges and precipices of incredible difficulty; and frost is so severe that no instrument of human invention can measure its intensity, and it blisters the skin like extreme heat.

The greatest progress that has ever been made across these wildernesses of storm, of fury and desolation, was at the rate of five or six miles in a day, the explorers often necessarily resting as many days as they had before travelled miles in a single day, debarred by the obstacles that they had encountered.

The Coal Area of the World.

The coal area of the world is distributed as follows:

	Sq. Miles.		Sq. Miles.
United States	192,000	Germany	1,800
British America	18,000	Belgium	518
Great Britain	12,000	Rest of Europe	100,000
Spain	4,000	China	2,000
France	2,000	Japan	5,000

Railroad Facts.

The cost of railroads in the United States has been $9,000,000,000.

One million persons are employed by the railroads of the United States.

The cost of a high-class eight-wheel passenger locomotive is about $8500.

The cost of a palace sleeping-car is $15,000, or if "vestibuled," $17,000.

The average cost of constructing a mile of railroad in the United States at the present time is about $30,000.

The average daily earning of an American locomotive is about $100.

The "consolidation" locomotive weighs about 50 tons, and is able to draw on a level over 2400 tons.

The longest mileage operated by a single system is that of the Atchison, Topeka and Santa Fe—about 8000 miles.

The line of railroad which extends farthest east and west is the Canadian Pacific, running from Quebec to the Pacific Ocean.

There are 60 miles of snow-sheds on the Central Pacific Railroad.

The highest railroad in the United States is the Denver and Rio Grande at Marshall Pass—10,852 feet.



THE BARTHOLDI STATUE OF LIBERTY

The longest American railroad tunnel is the Hoosac Tunnel on the Fitchburg Railroad—4½ miles. (The St. Gothard Tunnel in Europe is over 9 miles in length.)

There are 208,749 railroad bridges in the United States, spanning 3213 miles.

The longest railroad span in the United States is the Cantilever span in the Poughkeepsie bridge over the Hudson River—548 feet.

The highest railroad bridge in the United States is the Kinzua Viaduct on the Erie road—305 feet high.

The Manhattan Elevated Railroad of New York carries the largest number of passengers of any American road, over 200,000,000.

A steel rail lasts, with average wear, about eighteen years.

The Fastest Locomotive Ever Built.

The largest and fastest passenger engine ever built, was by the Rhode Island Locomotive Works, for the New York, Providence and Boston Railroad Company. The main driving wheels are six feet in diameter, and set but seven feet six inches apart. This arrangement makes her run easily on curves. The cylinders are eighteen inches in diameter, with twenty-four-inch stroke. The boiler is fifty-four inches in diameter at the smoke-stack, with a wagon top. It extends to the very end of the cab, and necessitates the elevation of the engineer's seat to a height far above the fire door. The fire requires three tons of coal before the engine pulls out of the round-house to make her trips, and four tons will be carried on the tender. The tank of the latter will hold 4000 gallons of water, and the total weight of the engine proper is 93,000 to 95,000 pounds.

She looks to be enormously high as she sets up well in the air, and her short smoke-stack adds to her apparent height. Everything about her is steel. There is not a particle of brass or bright work about her. She makes the run from Providence to Groton, Conn., a distance of 62.5 miles, including a dead stop at Mystic drawbridge, as required by the statutes of Connecticut, in just 62.5 minutes, pulling at the same time eight cars, four of which are Pullman's.

One Railroad in Palestine.

There is but one railway within the province of the Jerusalem consulate. This connects Jerusalem with the seaport, Jaffa, and it is 53 miles long. Its simple Oriental name is Chemin de Fer Ottoman de Jaffa a Jerusalem. It is a French corporation, but is practically controlled by the Turkish government.

The line is in fair condition, but the accommodations for passengers are very bad, and would not be tolerated by the traveling public of Europe or the United States. It is difficult to keep the line in good condition, owing to the heavy grades and short curves among the mountains. In the distance of 53 miles the ascent is nearly 2500 feet, most of which is made during the last half of the distance. The road is single track and narrow gauge. The daily service consists of one passenger and one freight train each way. The first-class fare between the termini is $3, and a round-trip ticket is sold for $4.

There are numerous railway lines in South Africa, the railroad-building industry having in recent years assumed very extensive proportions. Owing to the soft nature of the soil and the frequency of the rains, most of the roadbeds are in a state of chronic instability. There is regular railway communication between Pretoria and Cape Town, a distance of 1040 miles. The first-class passenger fare is 6 cents a mile.

The Great Siberian Railway—a through line across Siberia 4715 miles long—is now under construction in three sections. This is one of the biggest railway engineering enterprises ever undertaken, involving, as it does, the tunneling of great mountains and the building of enormous viaducts and bridges. The Cheliabinsk-Omsk line is fast nearing completion. The Middle Siberian section, the construction of which was begun in 1893, is now well under way, and it is hoped that it will be finished very soon. The main trunk of the great line is under contract to be completed not later than 1900.

To Sweden is given the distinction of owning more railway mileage per capita than any other country in Europe, and a Swedish road enjoys the further distinction of being the only railway in the world that enters the polar circle.

The Seven Wonders of the World.

The "pyramids" first, which in Egypt were laid;
Next "Babylon's garden," for Amytis made;
Then "Mausolo's tomb" of affection and guilt;
Fourth, the "temple of Dian," in Ephesus built;
The "colossus of Rhodes," cast in brass, to the sun;
Sixth, "Jupiter's statue," by Phidias done;
The "pharos of Egypt" comes last, we are told,
Or the "palace of Cyrus," cemented with gold.

The Wonders of the New World.

The group of natural objects that have been classed as the seven wonders of the new world are, Niagara Falls, Yellowstone Park, the Mammoth Cave, the Canyons and Garden of Gods, Colorado; the Giant Trees, California; the Natural Bridge, Virginia, and the Yosemite Valley.

DATES OF FIRST OCCURRENCES

AFFIRMATION of the Quakers first accepted as an oath, 1702.

AIR-GUNS invented 1646; for throwing shells, 1886.

AMPHITHEATRE in Rome built A. D. 69.

AMPHYCTIONIC COUNCIL or General Assembly of Greece established B. C. 1497. This is the first instance on record of a free representation of independent states meeting to deliberate and settle their concerns by force of reason in place of arms.

ARITHMETIC by the Arabian figures introduced into Europe by the Saracens of Spain in the ninth century of the Christian era.

ASSASSINATION of Lincoln, April 14, 1865.

BAFFIN'S BAY, separating Greenland from North America, discovered by Captain Baffin in 1662.

BALLOONS said to have been invented by Gusmac, a Jesuit, 1729, but probably invented much earlier, and first used in France by Montgolfier in 1782.

BANKS in the United States commenced in the early part of the Revolutionary War. The first by a number of gentlemen in Philadelphia, June 17, 1780, with a capital of $839,160; instituted for the purpose of supplying the American army with provisions.

BAROMETERS invented by Forricelli, 1643.

BAYONETS invented at Bayonne, in France, 1670.

BLOOD, circulation of, through the lungs, first made public by Michael Servetus, a French physician, in 1553.

BOOKS in the present form were invented by Attalus, King of Bergumus, 887; the first supposed to be written in Job's time.

BREAD first made with yeast by the English, 1650.

BRICKS first used in England by the Romans—the size ordered by Charles I., 1625.

BURNING GLASS and common mirrors date back to 1680.

CABLE, first Atlantic, operated 1858.

CANALS are of very ancient date, the first of which we have any record being that in Egypt between the Nile and Red Sea.

CARDS invented in France; first used for amusement by Charles VI., 1380.

CARRIAGES first introduced into Vienna 1515, into London 1580.

CHESS, the game of, invented B. C. 608.

CHINA, first voyage to, from the United States, 1784.

CHINA, PORCELAIN, first spoken of in history 1591.

CHLOROFORM was discovered in America and Germany, 1831. In 1847 it was brought into prominent notice as an anæsthetic by Sir James Simpson, of Edinburgh.

COLLEGE, Harvard is the oldest in the United States, established 1638.

COTTON first raised in Virginia 1621, first exported 1741.

CHRISTMAS day first observed as a festival, 98.

CIRCUMNAVIGATORS of the globe; the first was Magellan, or rather by his fleet, as he was himself slain on the voyage, 1522.

CLOCKS made to strike by Arabians, 800; by Italians, 1200.

CLOTH, coarse woolen, first made at Kendal, 1390.

COAL discovered near New Castle, England, 1234.

COIN, silver, coined in China, 1200 B. C.; in Rome, 576; in England, 1101.

COLLEGES as places of public instruction, in which academical degrees were granted, first established at Paris, 1215.

COMMERCE first mentioned in the book of Genesis, when Joseph's brethren sold him to a caravan of Ishmaelites.

COMPASS in use in Europe as early as 1180; variation first observed by Columbus and his companions, 1492; used in China, 2634 B. C.

CONGRESS, Continental, first met in Philadelphia, September 5, 1774.

COPPER MINES found in New York, 1722.

COUNCILS. The first Nicene, when 328 fathers attended against Arius, 325; at Nice, when Pope Adrian presided and 350 fathers attended, 787.

CHRISTIANITY was propagated in Spain in 36; in Britain, 60; or, as others say, in the 5th century; in Franconia and Flanders, in the 7th century; in Lombardy, Thuringia and Hesse, in the 8th century; in Sweden, Denmark, Poland and Russia, in the 9th century; in Hungary and Sclavonia, in the 10th century; in Vandalia and Prussia, in the 11th century; in Pomerania and Norway, in the 12th century; in Livonia, Lithuania and part of Tartary, in the 13th century; in Sclavonia, part of Turkey, and the Canary Isles, in the 14th century; in Africa, at Guinea, Angola, and Congo, in the 15th century; made great progress in Prussia, both the Indies and in China, by the Protestant faith, in the 16th century; reinstated in Greece, &c., &c., in the 17th century.

DELFT EARTHENWARE first made at Faenza, 1450.

DISTILLATION of spirituous liquors began in the 12th century; in Ireland, 1590.

ELECTRICITY, first idea of, given by two globes of brimstone, 1467; electric spark discovered at Leyden, 1746; first known it would fire spirits, 1756.

EMANCIPATION PROCLAMATION, by President Lincoln, January 1, 1863.

ENGRAVING on metal plates known in Europe, B. C. 504; on wood, invented in Flanders, 1423; on steel, became common about 1830; lithographic, invented by Senefelder, a German, about 1796.

ENVELOPES were first used in 1839.

ETCHING on copper, with aqua fortis, invented -512.

FIRE ENGINE, to force water, invented 1663.

FLAG, American, first used at Cambridge, Mass., by Washington, January 1, 1776. Legally established by Congress, June 14, 1777.

GAS, use of, introduced into London for lighting shops and streets, 1814; first into the United States, at Baltimore, 1821.

GILDING with leaf gold invented by Margaritone, 1273.

GYPSIES quitted Egypt, when attacked by the Turks, in 1515, and wandered over all Europe.

GLASS, the art of making it, known to the Romans before 79; Egypt, 1740 B. C.; the Chinese about 200; introduced into England by Benedict, a monk, 674; glass windows began to be used in private houses in England, 1180; glass first made in England into bottles and vessels, 1757; the first plate glass for looking glasses and coach windows, made at Lambeth, 1673; in Lancashire, 1773; window glass first made in England, 1557.

GOLD was first discovered in California, in 1848.

GRIST MILLS invented in Ireland, 214.

GUNPOWDER credited to Chinese; rediscovered, 1324.

HABEAS CORPUS ACT in England passed, 1641; attempt made in the Senate of the United States to suspend it, but rejected by the House of Representatives, 1806.

HACKNEY COACHES first used, 20 in number, in London, 1625.

HAIR POWDER in use in England, 1590; a guinea per year tax on those who wear it, 1795.

HANDKERCHIEFS first manufactured at Paisley in Scotland, 1748, when $80,000 worth were made.

HATS invented at Paris, 1404; first made in London, 1510.

HERALDRY had its rise about the year 1100.

HOUR GLASSES were invented in Alexandria, 240, and introduced at Rome 158 years B. C.

HUDSON'S BAY discovered by Captain Hudson, 1607.

INDIGO first produced in Carolina, 1747.

INFALLIBILITY. The dogma of Pagal Infallibility promulgated in 1870.

INOCULATION first tried on criminals, 1741; vacine discovered by Dr. Jenner, 1799.

INSURANCE on shipping began in England, 1560.

IRON discovered by the burning of Mt. Ida, 1406 B. C.; first cast in England, at Backstead, Sussex, 1544; first discovered in America in Virginia, 1715.

IRON STEAMSHIP, the first was built in 1830.

JUPITER'S SATELLITES discovered by Jansen, 1590.

JURIES first instituted by Ethelred II., King of England, 979; the plaintiff and defendant, in those times, used to feed them; whence the common law of denying sustenance to the jury after hearing evidence.

KEROSENE first used for illuminating in 1826.

KINGDOM, origin of, by Nimrod at Babylon, 2233 years B. C.

KING'S EVIL supposed to be cured by the touch of the Kings of England, the first king being Edward the Confessor, 1058. It was dropped by George I.

KISSING the Pope's foot first practiced, 709.

KNITTING STOCKINGS invented in Spain about 1550.

KNIVES first made in England, 1550.

LAMP for preventing explosion by fire-damp in coal mines, invented by Sir Humphrey Davy, 1815.

LANCASTRIAN SCHOOLS of education established in most of the principal towns of England, 1810.

LAWNS AND THREAD GAUZE were manufactured at Paisley in 1784.

LETTERS invented by Memnon, the Egyptian, 1822 B. C.

LIBERTY BELL, the most famous bell in America, relic most prized by the nation, hung in the tower of Independence Hall, Philadelphia, 1776, and was rung when the Declaration of Independence was adopted. It was cracked while tolling for the death of Chief Justice Marshall, 1835, and has never been put to public use since. It was exhibited at the World's Fair, Chicago, 1893, and at the Atlanta Exposition, 1895.

LINEN first made in England, 1253; the rich people wore linen, the poorer woolen shirts.

LOCOMOTIVE, the first use of one in this country was in 1820.

LOCUSTS, the country of Palestine infected with such swarms of, that they darkened the air, and after devouring the fruits of the earth, they died, and their intolerable stench caused a pestilential fever, 406. A similiar circumstance occurred in France, 873; a large swarm of, flew over the city of Warsaw, June 17, 1816; swarms of, made their appearance near Aschersleben, June 24, 1816.

LOOKING-GLASSES made only at Venice, 1300.

LOOMS, the power loom invented by the Rev. Mr. Cartright, a clergyman of Kent, England, 1787.

LOTTERIES, the first mentioned by historians for sums of money, 1630.

MAGNIFYING-GLASSES first made in England by Roger Bacon, 1260.

MAMMOTH, first fairly complete one discovered near the mouth of the Lena, in Siberia, 1806.

MAPS AND GLOBES invented by Anaximander, 600 B. C.

MARBLE PAPER, a German invention belonging to the 17th century.

MATCHES, friction, first used in 1829.

MECKLENBURG Declaration of Independence issued May 31, 1776.

MICROSCOPES first used in Germany, 1621; the double ones, 1624; solar microscopes invented, 1740.

MILITARY ACADEMY, West Point, founded by Congress, March 16, 1802.

MISSOURI COMPROMISE passed March 3, 1820, and appealed May 24, 1854. It restricted slavery to south of 36° 30′.

MONASTERY, the first founded where the sister of St. Anthony retired, 270; the first founded in France, near Poictiers, by St. Martin, 360; Constantine IV. sends for a great number of friars and nuns to Ephesus, orders them to change their black habits for white and to destroy their images; on their refusal he orders their eyes to be put out, banishes them, and sells several monasteries, appropriating the produce, 770; they were totally suppressed by Act of Parliament in 1539.

MONEY, first mentioned as a medium of commerce in the twenty-third chapter of Genesis, when Abraham purchased a field as a sepulchre for Sarah, in the year of the world 2139; first made at Argos, 894 B. C.; has increased eighteen times its value from 1290 to 1640; and twelve times its value from 1530 to 1800.

MONROE DOCTRINE declared in the message of President Monroe, December 2, 1823. Re-asserted by President Cleveland in a message to Congress concerning the boundary line dispute between Venezuela and Great Britain, December, 1895.

MORMONS, sect of, founded by Joseph Smith, 1830; removed from Nauvoo to Salt Lake Valley, Utah, July 24, 1847.

MUSICAL NOTES invented in 1070; improved, 1330; printed, 1502.

NANTES, Edict of, tolerating Protestants, 1598; revocation, 1685.

NEEDLES first made in England by a native of India in 1545.

NEW ORLEANS, battle of, January 8, 1815, Jackson defeating the British. Captured by Farragut, April 26, 1862.

NEWSPAPER, the first authentic copy was printed in 1494; first daily, *Frankfort Gazette*, 1615. The first English was the *Weekly Newes*, 1622; the first in France, *Gazette de France*, 1631. The first advertisement appeared in 1648. The first American newspaper was printed in Boston, September 25, 1690, and was called *Publick Occurrences, Foreign and Domestic*. The first continuously printed in America was the *Boston News Letter*, 1702; first daily, *The Pennsylvania Packet*, 1784.

NULLIFICATION ORDINANCE passed by South Carolina, November 19, 1832. The proclamation of President Jackson denouncing the same was issued December 10, 1832.

ORGANS were invented in 755.

OXFORD UNIVERSITY, England, founded by Alfred, 886.

PAINTING, earliest account of, in the reign of Ninus, about 2000 B. C.

PAPER CURRENCY established in America May 15, 1775. Paper money first used in America, 1740.

PAPER made from silk, China, 120 B. C.; from rags, Egypt, 1085.

PARCHMENT invented by King Attalus of Pergamus, 887 B. C.

PATENT RIGHT LAW first enacted in United States, April 15, 1790.

PAVING with stones first introduced, in Paris, 1186.

PEARLS, artificial, were invented 1686.

PENS for writing were first made from quills in 635. The substitution of steel for quill pens took place early in the present century, yet strange to say, nothing is known with certainty of the person who first invented the metallic pen. Fountain pens and glass pens are of recent date.

PENNYPOST set up in London and suburbs, by one Murray, an upholsterer, 1681, who afterwards assigned the same to one Dockwra; afterwards claimed by the government, who allowed the latter a pension of £200 a year, in 1711; first set up in Dublin, 1774; it was improved considerably in and round London, July, 1794; made a two-penny post in 1801.

PHILADELPHIA was founded by William Penn in 1682. Riots, native American and Irish, May 6 to 8, 1844. First National Convention of the Republican Party, 1856.

PHONOGRAPH invented in 1877 by Thomas A. Edison.

PHOSPHOROUS first made in 1677.

PHOTOGRAPHS were first produced in England in 1802; perfected in 1841.

PIANOFORTE invented about 1710 in Italy.

PINS were brought from France, and first used in England by Catherine Howard, Queen of Henry VIII. Before that time both sexes used ribbons, loop-holes, laces with points and tags, hooks and eyes, and small skewers made of gold, silver and brass. Pins were first made by machinery in America in 1832.

PIPES OF LEAD, for water, first cast in 1539.

PISTOLS first used by the cavalry in 1544.

PITCH and tar first made from pit coal at Bristol, in 1779.

PLASTER OF PARIS. Casting with it from the face invented in 1470.

PORCELAIN of Saxony greatly improved in 1767.

PORT-HOLES introduced for ships of war in 1545.

POST-OFFICE first established between Vienna and Brussels in 1516. Posts established regularly between London and all the principal towns throughout England in 1635. Postage stamps were introduced in England in 1840; in the United States in 1847.

POTTERY improved greatly by Wedgwood in 1763.

PRINCE OF WALES, the title of, first given to the king's eldest son, 1286.

PRINTING. The Assyrians and Babylonians used clay tablets, and wooden blocks were used by the Chinese as early as 952. Printing from movable types was invented by Faust in 1441, and made public by Gutenberg in 1454, although the invention is also claimed for L. Koster, of Haarlem, as early as 1423. The first Bible was printed by Faust and Schoffer, in 1456, and they also printed the first book with date, a Latin Psalter, 1457. Wooden type first introduced into England, by William Caxton, a London merchant, in 1477. The first English press was set up in Westminister Abbey, where it remained until 1494. The first American book, "Escala Espiritual," was printed by Juan Hablas, Mexico, about 1535. The first press in the United States was that of Stephen Daye, at Cambridge, Mass., 1639. Printing in colors was first introduced in 1626.

PYRAMIDS first erected about 2170 B. C.

QUICKSILVER first used for refining silver ore, in 1540.

RAILROAD. The first passenger railroad was opened in England, September 27, 1825; the first in America, Baltimore and Ohio, 1828, although freight was moved by rail at the granite quarries, of Quincy, Mass., as early as 1826. The first steam railroad was operated in the United States in 1830, from Albany to Schenectady—16 miles.

REFORMATION in Germany, 1517; in England, 1532.

REPUBLICAN PARTY. The first convention was held at Pittsburgh, February 22, 1856.

RESUMPTION of Specie Payments in the United States—Act approved 1875; took effect January 1, 1879.

RIBBON LOOMS. It has been asserted that these looms were first known to the Swiss, but others claim their invention for a German in the town of Dantzic in the 16th century.

RULING-MACHINES invented by a Dutchman in London in 1792.

SADDLES. Pliny informs us that one, Pelethronius, was the first to introduce a piece of leather fastened to the back of a horse for the accommodation of its rider. For a long time these cloths and pieces of leather were regarded as unmanly, and were, therefore, regarded by soldiers with great scorn. The old German races despised the Roman cavalry for riding on such effeminate contrivances. Saddles of the kind now used appear to have been in use in 385. Side-saddles first used in 1380. Previous to their introduction women always rode astride.

SAILCLOTH first made in England in 1590.

SALTING HERRINGS after the Dutch method first used in 1416.

SALTPETER first manufactured in England, in 1625.

SAWS. The inventor of the saw is said, by the old Greek writers, to be Talus or Perdox. Pliny ascribes the invention to Dœdalus, but Hardouin affirms that the passage in which he does so refers to Talus, and not to Dœdalus. Talus was the son of a sister of Dœdalus, and the invention is said to be due to his using the jawbone of a snake to cut through a piece of wood. His master grew jealous of the honor Talus won by this invention, and caused him to be privately put to death.

SCHOOLS, public or common, first known in America, were established in the New England States about 1642.

SEDAN CHAIRS introduced into England in 1734.

SEWING-MACHINE first patented in England, in 1755. The first complete machine was constructed by an American, Elias Howe, in 1846.

SEXTANT invented by Tycho Brahe, at Augsburg, in 1550.

SHAY'S REBELLION, in Massachusetts, 1786–87.

SLEEPING-CARS were first used in 1858. Pullman's patent dates from 1864.

SOAP first made in London and Bristol in 1524. The first express mention of soap appears in Pliny and Galen. The former speaks of it as an invention of the Gauls.

SPEAKING-TRUMPETS invented by Kircher, a Jesuit, in 1652.

SPINNING-WHEEL invented at Brunswick, 1530.

SPECTACLES invented by Spina, a monk, of Pisa, in 1299.

STAMP ACT enacted March 22, 1765; repealed March 19, 1766.

STATUTES of the United States first revised and codified in 1873.

STEAM. The steam engine boiler was discovered by the Marquis of Worcester in 1663. Newcommen's engine was patented in 1705, and the invention was perfected by James Watt in 1773. The high pressure engine was invented by an American, Oliver Evans in 1779. The first steam vessel of which there is any record was that of Papin (France), in 1707. Then follow those of Jonathan Hulls (England), 1736; William Henry (Conestoga River, Pa.), 1763; James Rumsey (Md.), 1786; John Fitch (Delaware River), same year. In 1806 Robert Fulton constructed the Clermont, which plied regularly between New York and Albany, at a speed of five miles per hour. The first steamer crossing the Atlantic made the voyage from Savannah to Liverpool in twenty-five days, A. D. 1819.

STEEL. The invention of steel is of very great antiquity and the process of hardening iron is described in the Old Testament (Isaiah xliv, 12). The helmet of Hercules, described in Hesiod, appears to have been of steel. Homer refers to the process of hardening steel by immersing it, while red hot, in cold water.

STEREOTYPE PRINTING invented by William Gid, a goldsmith, of Edinburgh, in 1735.

STIRRUPS, according to a statement made by the Emperor Mauritius, were first used in the 6th century. Hippocrates and Galen speak of a disease which, in their time, was occasioned by long and frequent riding, because the legs hung down without any support.

SUGAR is first mentioned in 625 by Paul Eginetta, a physician. It came originally from China and the East; was produced in Sicily in 1148, in Maderia in 1419, in the Canary Islands in 1503, and in the West Indies by the Portuguese and Spaniards in 1510. In 1641 it was cultivated at Barbadoes. Sugar-refining was first carried out by a Venetian in 1503, and this process was adopted in England in 1569. Sugar cane was first cultivated in the United States in 1751, near New Orleans, the first sugar mill being constructed in 1858.

SUNDAY-SCHOOLS were first established by Robert Raikes, Gloucester, England in 1781.

SUN-DIALS invented 558 B. C. The first in Rome, 308 B. C., was that erected by Papirius Cursor, when time was divided into hours.

TANNING LEATHER. A new and more expeditious method than that previously in use was invented in 1795.

TAX. The first tax levied on the people was by Solon, 540 B. C.

TEA first known in Europe in 1610, being brought from India by the Dutch.

TELEGRAPHS (mechanical) invented in 1687. First used by the French in 1794, and by the English in 1796. The first electric telegraph was operated from Paddington to Drayton, England, in 1835, the same year in which Morse's telegraph was invented. The first telegraph line in operation in America was between Baltimore and Washington in 1844. The first submarine cable was laid in 1851, between Dover and Calais, and the first Atlantic cable was operated in 1858.

TELEPHONE. A. Graham Bell first presented a speaking telephone at the Centennial Exposition, Philadelphia, in 1876.

TELESCOPES. The first reflecting telescope made on the principle discovered by Sir Isaac Newton in 1692.

TEMPERANCE SOCIETY, the first in this country was organized in Saratoga County, N. Y., in March, 1808.

THREAD first made at Paisley, Scotland, in 1722.

THERMOMETERS first invented by Drebel, a Dutchman, in 1620; improved by Reaumur in 1730, and by Fahrenheit in 1749.

TOBACCO was first introduced into England, from Virginia, in 1583.

UNION of England and Scotland, 1707; Great Britain and Ireland, 1801.

VACCINATION. See *Inoculation*.

VENTILATORS first introduced by the Rev. Dr. Hales in 1740.

VIOLINS of the modern kind invented about 1477. Introduced into England by Charles II.

WALL-PAPERS first used in Spain and Holland in 1555. Flock or velvet wall-papers were first used in 1620.

WAR SHIPS. In 1814 Sir Robert Seppings introduced various most important improvements for the construction of war ships. The lower parts of the frames of ships of war were then, for the first time, filled in, a system of diagonal trussing was introduced, the stern was altered in form, so that it no longer remained open to the fire of an enemy, and the upper decks were enlarged. Sir W. Symonds altered them so as to decrease the quantity of ballast required in 1832. In the International Exhibition of 1851 various improvements in this direction were shown, but great iron-cased ships were not then thought of. In July, 1854, the first of a new class of screw, gun vessels was launched for use during the Russian war. To operate with these, vessels of iron were constructed to bombard the fortresses in the Baltic. The first French iron-cased ship was a frigate called the "Cloire," and this was quickly followed by the first English ship of that kind, the "Warrior." Since then vessels of this kind have been subject to a variety of alterations and experiments tending to improve both their strength and their sailing qualities. The first battle between iron ships of war occurred in the war for the Union, the Merrimac and Monitor being the contestants.

WATCHES were invented at Nuremberg in 1477, and were first introduced into England from Germany in 1577.

WATER MILLS for grinding corn are said to have been invented by Belisarius when Rome was besieged by the Goths in 555. Pliny, however, mentions wheels turned by water.

WEATHER-COCKS. The earliest mention of a weather-cock is that made by Vitruvius, concerning that on the tower built at Athens by Andronicus Cyrrhestes.

WILD-FIRE invented by a Greek in 663.

WILMOT PROVISO, to restrict slavery, offered in the House of Representatives, August 8, 1846, by David Wilmot, of Pennsylvania.

WIRE invented at Nuremberg in 1351.

WIRE-DRAWING. The first record we have of this art is probably that contained in Holy Writ, where we are told that gold was beaten and cut to threads, so that it could be interwoven in cloth. The present mode of forming metallic threads, that known as wire-drawing, was first known in the 14th century.

WOOLEN CLOTH. Although the making of woolen cloth is one of the most ancient arts, its manufacture was not known in France until 1646, when it was made at Sedan. It was first made in England in 1331, but was not dyed or dressed until 1667.

YELLOWSTONE NATIONAL PARK established by Act of Congress, February 28, 1871.

THE COUNTRIES

OF THE

WORLD

Historical and Statistical Information.

A CONDENSED history of the nations of the globe, containing information relating to the forms of government and present condition of the people, is not only of interest to the general reader, but also furnishes information of great value. In this way the ends of the earth are brought near. A panorama of past events, including those of most recent date, passes before the eye. Here, also, means are afforded for obtaining that culture which cannot be complete without a knowledge of the world at large.

It must have occurred to every student of history that there are great masses of rubbish of no account, which are, in fact, a hindrance and vexation. Only by condensing the voluminous records of the past, and bringing them within a narrow compass, are we able to trace the golden chain of events.

The following pages present the essential facts of history, enabling the reader to obtain a clear and intelligent idea of those annals which preserve the life and deeds of nations The aim has been to depict great historic features, furnishing a record of the most important transactions, and otherwise gathering into this treasury of knowledge such information as will be of the greatest practical value. This comprehensive survey of the countries of the world forms a ready hand-book for everyday use.

A Fountain of Knowledge.

That a knowledge of history, ancient and modern, forms an important part of education, is conceded by every thoughtful person. For this reason the study of this subject is required in all our schools and academies, and it is admitted that a finished education demands a thorough acquaintance with history, no less than with the common branches universally taught, or with the sciences and ancient languages. This subject is one of the great sources of the world's knowledge and wisdom, and while it has its dry details and facts, it is also invested with romance, the charm of which never dies.

The comprehensive history of nations includes their origin and certain great features which have resulted from political changes. We behold revolutions, sanguinary battles, struggles for better forms of government, the peaceful achievements of diplomacy, and mark the great convulsions, victories and enterprises, which have changed the pages that record the annals of the past, and, as it were, have formed the world anew.

THE UNITED STATES

AMERICA, including a vast extent of territory, embracing every variety of climate, and bearing within it, besides its precious ore and gems, the germs of immense wealth, remained undiscovered until the 11th of October, 1492, when Christopher Columbus, a native of Genoa, who had sailed from Spain with three small vessels under the patronage of Ferdinand and Isabella, the Castilian monarch, first beheld a light on the shore of the new continent, two hours before midnight. On the next day he set foot in the New World.

The Christian adventurers did not fail to kneel upon the sand and offer up their thanks for having been preserved through the perils of a long voyage. This island was called Guanahani, by the natives, a name which Columbus altered to St. Salvador, and was one of the Bahama Islands.

It is worthy of remark that the vast continent which Columbus discovered was not called by his name, but derived its appellation from Amerigo Vespucci, a Florentine navigator, who made some subsequent discoveries, in company with Alonzo de Ojeda, in 1499. Columbus did not rest satisfied with his first successful voyage or the fame which he acquired by it, but he undertook others. He was, however, in the end, the victim of jealousy and ingratitude. The Spanish colonists at Hispaniola became discontented and preferred complaints against him, sending home accusations and remonstrances by every ship that sailed to Spain.

The Discoverer in Irons.

In consequence of this, Don Francisco de Bobadilla was sent out by the court, and invested temporarily with the chief power, being permitted to use his own judgment in quelling the disturbances of the colonies. This person scrupled not to arrest Columbus and put him in irons, from which he would not suffer himself to be freed, when he was sent to Spain.

"No," said he, when the attendants offered to remove them; "the truth must be apparent, and my patrons are too noble, too generous to overlook me. Then, if fortune again smiles upon me, these will serve as affecting memorials of sorrow past; I will not part with them, and I even wish that, when I am no more, they may be suspended over my sepulchre." When he again set foot in Spain, he might have exclaimed, in the language of the poet:

"Are these the wreaths of triumph you bestow
On those who bring you conquest home and honor?"

Columbus was liberated immediately by royal order, and received at court with great respect. But though Bobadilla was recalled, Columbus in vain supplicated to be restored to his government; he was put off by vague promises, and the post finally given to Don Nicholas Ovando, a practical as well as accomplished man. Thus after three momentous voyages, and the acquisition of much fame, he found himself displaced and thwarted in a point in which he conceived his honor concerned, and his hard-earned authority torn from his possession.

But it was not the nature of Columbus to sink under his misfortunes; on the contrary with four small caravels, the largest being but of seventy tons burthen, he set out on his fourth voyage of discovery with the intention of completing the circumnavigation of the globe, visiting the Indies, of which Vasco da Gama had given so inspiriting an account.

A Singular Occurrence.

Leaving Cadiz on May 9, 1502, he reached Martinique, one of the Windward Islands, June 15. Having touched at Cuba, he pursued a southwesterly course, until he reached Guanaja, an island on the coast of Honduras, whose inhabitants had attained a pretty high degree of civilization. Their persons were covered with cotton garments dyed with a variety of bright and pleasing colors.

He mentions a curious occurrence as taking place here. He had been presented, among other animals, with a peccary, or American pig, and one of those monkeys with prehensile tails, indigenous to America. The peccary being thrown in the way of the monkey, the latter, by a dexterous use of its tail, confined the jaws of the pig in such a manner as to expose it helplessly to the action of the monkey's claws. "This appeared to me so strange," Columbus writes to his patrons, "that I thought fit to write it down for the information of your majesties."

The Spaniards entertained the most exaggerated ideas of the wonders of the New World. To most of them, it appeared a realm of magic, a fairyland, in which supernatural occurrences were by no means infrequent. Thus Juan Ponce de Leon, in 1512 fitted out three ships from Porto Rico, of which he was governor and set forth in search of an Indian fountain which was fabled to restore all who bathed in it, even if they were tormented by the infirmities of extreme old age, to the freshness, vigor and beauty of youth. Although he failed to find the fountain, he made the discovery of Florida.

Extinction of the Red Men.

From the time of the first European settlements in this part of America, the number of the Indians has diminished rapidly, and they are now reduced to a mere handful, whom the wave of emigration is fast rolling to the shores of the Western Ocean. They have seen their hunting grounds diminished, their forests swept away by their white foes, and the smoke of the Christian village rising where once their council-fires blazed.

The discovery of America awakened the enterprise of various nations of the Old World, and they fitted out numerous expeditions to conquer and colonize. North America, which is of vast extent, its surface containing about eight millions of square miles, fell into the hands of the English, French and Spanish. Mexico, so valuable for its mines of gold and silver, inhabited at the period of its discovery by intelligent and peaceable nations, was conquered by Fernando Cortez, a Spanish general, who scrupled not to make use of the basest treachery, and to shed the blood of the natives like water,

to accomplish his purposes. Mexico was for a long time attached to Spain, to which it furnished immense wealth, but at present has a republican government which it can hardly be said to enjoy, the country is in such an unsettled state.

The eastern shores of North America, were settled principally by the English. In spite of the hostility of the Indians, the ravages of disease and hardship, the colonies increased rapidly. The population of the middle portion of North America, now called the United States, was estimated, in 1775 at about 3,000,000. The number of the colonies was thirteen. Poverty and oppression had first driven them from their native land.

Settlement of the Colonies.

The following dates of the settlement of the colonies, are given for reference:

Virginia, 1607.

New York, by the Dutch, 1614; occupied by the English, 1664.

Plymouth, 1620; incorporated with Massachusetts in 1692.

Massachusetts, 1628.

New Hampshire, 1623.

New Jersey, by the Dutch, 1624; occupied by the English in 1664.

Delaware, by the Dutch, 1627; occupied by the English in 1664.

Maine, 1630; united with Massachusetts in 1677.

Maryland, 1633.

Connecticut, 1635.

New Haven, 1637; united with Connecticut in 1662.

Providence, 1635; Rhode Island, 1638; } united 1644.

North Carolina, 1650.

South Carolina, 1670.

Pennsylvania, 1682.

Georgia, 1733.

The English settlers in the northern parts of America, were influenced by different motives from those which actuated the Spaniards who quitted their native country for the shores of the New World. The latter were urged onward by a reckless spirit of adventure, by the promptings of heated imaginations, and by the most insatiable cupidity. The former were impelled by far worthier motives. Many causes operated together in the mother country, to favor emigration among the resolute and hardy.

The people of England had been led to examine the nature of the power to which they were subjected, and the monstrous doctrines of prerogative and religious intolerance, were denounced by many who had courage to think and speak for themselves upon the subjects. The friends of republican institutions multiplied with great rapidity, the natural result of the progress of literature, and the increase of wealth with the commons. In 1628 the wealth of the House of Commons far exceeded that of the House of Lords.

The English Puritans.

At the same time, the reformation which had been carried into effect by Henry VIII, while it had purged the country of many abuses long complained of, had established a form of worship which was regarded by many as little better than that which had given way before it. Those who refused to conform to the established form, contemptuously termed *Puritans* by their opponents, and anxiously sought scope for the exercise of religious rights, and, since the immunities they demanded were not granted them at home, determined to seek refuge from persecution in a remote quarter of the globe.

King James granted, in 1606, letters patent to two companies, called the London and Plymouth Companies, by which possession


1620

was given them of the territories lying between the 34th and 45th degrees of north latitude; the southern part to the London, and the northern part to the Plymouth Company: the king himself having undertaken to frame for them a code of laws.

Three ships were provided by the London Company, on board of which were 105 persons, who were expected to remain at Roanoke, which was the place of their destination. They made a settlement on a peninsula and called it Jamestown. This was the first permanent settlement made by the English in Virginia.

Story of Captain Smith.

Shortly after, the company received supplies from England, and an accession to their numbers, swelling the number to 200. Two vessels were freighted for England; one loaded with a yellow and brilliant sand, common in many places in the vicinity, but supposed by the colonists to contain a large proportion of gold; the other vessel was loaded with tobacco. The most efficient member of the council was Captain Smith, who was taken by the Indians while on an exploring expedition.

He was led to the place of execution, and his head placed upon a stone, while Powhatan, the Indian chieftain, stood over him with uplifted club, regardless of the earnest solicitations of his daughter Pocahontas, then about 13 years of age. The princess, finding her entreaties unavailing, fell upon Smith, folded him in her arms, and laid her face upon his, determined to meet death with him she could not save. Moved by this touching devotion, Powhatan relented, and, two days afterwards, sent Smith to Jamestown.

In 1609, the destruction of the whole colony was planned by the Indians, but their plans were defeated by the exertions of the princess Pocahontas, who, in a dark night, went to Jamestown, and put the president upon his guard. Pocahontas married an English gentleman by the name of Rolfe, embraced the Christian religion, and was baptized by the name of Rebecca. She died four years after at Gravesend, on her return with her husband from England. In 1619, twenty negroes were brought to Virginia in a Dutch vessel, and sold to the colonists, whence one may date the commencement of the slaveholding system.

In 1614 Captain Smith was sent from England to explore North Virginia. He ranged the coast from Penobscot to Cape Cod, making observations on the shores, harbors, islands and headlands; and made a map of the country, which on his return to England, he showed to Prince Charles (afterwards Charles I), who gave it the name of New England.

Arrival of the Pilgrims.

The Rev. Mr. Robinson with his flock, of the Reformed Church of the North of England, removed to Amsterdam in 1606, and soon after to Leyden. A variety of motives led his congregation to turn their attention to the New World; the principal were, the enjoyment of perfect liberty of conscience; "the preservation of ecclesiastical affairs distinct from those of the State;" and a hope of laying the foundation of an extensive empire, that should be purged from all religious impurities.

Having made an arrangement with the Virginia Company, they sailed from Plymouth, Eng., on September 6, 1620, and on November 10th anchored in Cape Cod harbor. Perceiving that they were so far north as to be without the territory of the South Virginia Company, some hesitation arose;

but the winter was at hand, and it was now too late to go in search of a settlement within the jurisdiction of that company.

Previous to their landing, after prayer and thanksgiving, they formed themselves into a body politic, binding themselves by a written covenant to be governed by the decisions of a majority. This instrument was subscribed by 41 persons, who, with their children and domestics, composed a company of 101 persons. Mr. John Carver was chosen, without one dissentient voice, governor for one year.

Saved from Famine.

Parties were sent on shore to make discoveries. Some Indians were seen but could not be overtaken. A considerable quantity of corn was found in heaps of sand, secured in baskets, which served for seed the ensuing spring, and tended to save the adventurers from famine. On December 6th, Carver, Standish, Winslow, Bradford and others, sailed to various places, to discover a suitable situation for a settlement. Monday, December 11, O. S., they landed at what was afterwards called Plymouth, and from the excellence of the harbor, and the favorable appearance of the land, resolved to commence a settlement here.

In 1637 the troops of Massachusetts and Connecticut had several engagements with the Pequot Indians, and finally subdued them. This year was made famous by a great theological disturbance caused by Ann Hutchinson, a woman of considerable talents, who was accused of maintaining heresies, and supporting them by lectures frequently given to large audiences. The result was a synod of the ministers, elders and messengers of the churches, who, after three week's deliberation, condemned as heretical eighty-two opinions which had been disseminated in New England, and some banishments took place, among them that of Mrs. Hutchinson, her husband and children.

In 1750 a number of noblemen, merchants and others, of London, together with some influential Virginia planters, formed a society under the name of the Ohio Company, for the purpose of commerce with the Indians and the settlement of parts of the country. The French Governor in Canada fearing the valuable fur trade of the French would be destroyed, infringed upon the possessions of the Ohio Company, who laid their grievances before Dinwiddie, Lieutenant-Governor of Virginia.

The Assembly of Virginia determined to demand, in the name of the King, that the French should desist. George Washington, then in his 22d year, was despatched to the French Commandant to convey the demand. As this was not complied with, the British determined to attack Fort du Quesne (now Pittsburg), and Washington commanded the expedition, which, although unsuccessful, reflected upon him great credit.

Brave to the Last.

On the arrival of Braddock, in the spring of 1775, various military operations were planned. An expedition against Canada was successful, but the conquered territory was speedily relinquished by the victors. General Braddock's expedition against Fort du Quesne was disastrous in the extreme. Heedless of the advice of Washington, who cautioned him against an ambush, he pressed forward, and was surprised by the Indians.

Instead of retreating or scouring the woods, Braddock vainly endeavored to form his men; and continued with wanton bravery on the spot where he was first attacked, till three horses were shot under him; when he received a shot through the lungs and fell.

The remains of the army immediately fled, bearing away the body of their rash and unfortunate commander. Every mounted officer except Washington, was either killed or wounded, and he was providentially preserved, for an Indian had marked him as a victim, and fired at him several times with a rifle that had never before deceived him; 64 out 85 officers, and half the privates were killed. But Washington bore off the wreck of the forces with consummate skill and undaunted courage. The war was continued until 1763, and, although the military operations were occasionally unsuccessful, the bravery of the British and provincial troops prevailed, and the fall of Quebec gave a death blow to the hopes of the French.

Events Preceding the Revolution.

We now come to the commencement of those acts which created that patrotic feeling in the colonies, which resulted in the Declaration of their INDEPENDENCE.

In 1674 the Parliament of Great Britain passed an act, the preamble to which ran thus: "Whereas it is *just and necessary* that a *revenue* be raised in America, for defraying the expenses of defending, protecting and securing the same, etc." The act then proceeds to lay a duty on clayed sugar, indigo, coffee, silk, molasses, calicoes, etc., being the produce of a colony not under the dominion of his majesty. To this the colonists submitted; though not without complaint and remonstrance.

Massachusetts recommended a colonial congress, to consult for the general welfare. A congress from most of the colonies, consisting of twenty-eight members, met at New York; remonstrated against the Act of Parliament; petitioned for its repeal; and made a declaration of the rights of the colonies; declaring that taxation and representation were inseparable; and that Parliament had no right to take their money without their consent.

In 1767, the Chancellor of the Exchequer brought into Parliament a bill for imposing a duty to be collected in the colonies on glass, paper, painter's colors and tea.

The Tea Thrown Overboard.

The colonists were again violently excited. The corresponding committees, which had been forming throughout the colonies for the last two years, excited resistance, declaring such as aided directly or indirectly in these violations of liberty, enemies to their country The consequence was that the cargoes of tea, sent to New York and Philadelphia, were sent back: and those sent to Charleston, stored, but not offered for sale. The tea ships, intended for the supply of Boston, after the inhabitants had tried in vain to have them returned, they being consigned to the relations of Governor Hutchinson, were entered by about seventeen persons in the disguise of Indians, and three hundred and forty-two chests of tea were thrown into the dock, no other damage being done.

In January, 1775, the Earl of Chatham brought forward a conciliatory bill in the House of Peers, which was rejected two to one. Lord North, the Prime Minister, introduced a bill for restraining the trade of the New England colonies. Receiving information of the general opposition in the southern colonies, he introduced another bill, equally restraining their trade, but excepting North Carolina, Delaware and New York.

The time had now come for testing the nerve of the colonists. An attempt was made by the British troops to seize the military stores at Concord, April 19, but they had to encounter the armed opposition of the militia at Concord and Lexington. Boston

was now blockaded. Ticonderoga and Crown Point were taken. The battle of Bunker's Hill followed, and an unsuccessful expedition against Canada preceded the Declaration of Independence.

On May 10, 1775, the Continental Congress met at Philadelphia, and on June 15, unanimously elected George Washington, then a member from Virginia, Commander-in-Chief of the forces raised, and to be raised, for the defence of the colonies. June 7, 1776, Richard Henry Lee, of Virginia, made a motion in Congress, for declaring the colonies free and independent. After much debate, on the Fourth of July, the thirteen colonies were declared free and independent, under the title of The United States of America.

Gallant Defence of the Fort.

An attempt was made in June and July, with 3000 British troops, under the command of General Clinton and Sir Peter Parker, to destroy the fort on Sullivan's Island, near Charleston (S. C.). The fort was defended by Colonel Moultrie with about 400 men. After an action of ten hours, the British were forced to retire with a loss of about 200 men. Ten Americans were killed and 20 wounded.

Soon after the evacuation of Boston by the British troops, March 17, Washington made his headquarters at the city of New York, with the principal part of the army. British troops to the number of 24,000 men under Lord Howe, and his brother, Sir William Howe, landed, August 22, on Long Island near the Narrows, about nine miles from the city. The American forces, at this time, amounted to upwards of 17,000 men, and those principally raw recruits.

A battle was fought on Long Island, August 27, in which the Americans were defeated. The battle of White Plains took place on October 28. The retreat of the American forces through the Jerseys and across the Delaware followed; the battles of Trenton, December 26, and Princeton, January 3, 1777, were also among the events of this period.

The campaign of 1777 closed under better circumstances. General Burgoyne surrendered at Saratoga, October 17. In 1778 a treaty of commerce and alliance was made between Louis XVI and the Commissioners of the United States, on February 6th. French troops soon after arrived. Various military operations ensued. In the Southern States, where there was no regular American army, the partisan warfare kept up by Marion, Sumter, Morgan, and Green, thinned the ranks of their enemies. On October 19, 1781, Cornwallis surrendered at Yorktown. The fall of this large British army may be considered as the closing of the war.

Public Thanksgiving.

General Washington ordered divine service in the different divisions and brigades. Congress went in solemn procession to the Dutch Lutheran Church in Philadelphia, returned thanks to Almighty God for the success of the combined armies, and recommended a day of general thanksgiving and prayer throughout the United States.

Savannah was evacuated in July, 1782, and Charleston in December. Great Britain acknowledged our independence November 30, 1782. Holland acknowledged the independence of the United States in April; Sweden in February, 1783; Denmark in the same month; Spain in March; Russia in July.

The debt of the United States, at the close of the war, was $40,000,000. Congress had power to make war, and to create debts, but no power to carry on the war, nor ability to pay debts, but by appeals or recommendations to thirteen independent sovereignties,

whose unanimity alone, seldom to be expected could support public credit, or give efficacy to the proceedings of Congress.

The new Federal Government was established in 1789. Washington was unanimously chosen first President, and John Adams Vice-President. Mr. Jefferson was selected for the Department of State.

Depredations by France.

The Indian War and an insurrection in the western part of Pennsylvania, on account of the tax on domestic spirits were favorably terminated. The insults and maritime depredations committed by the French, induced America to take up arms in defence of her rights, but a change of rulers in France prevented the effusion of blood. On the retirement of Washington, John Adams was elected to succeed him, and in 1801, Thomas Jefferson was chosen the third President of the United States.

The claim of searching American vessels, and impressing from them British seamen, and the British orders in council prohibiting the exportations of the United States, together with other outrages committed by the British, produced a declaration of war against Great Britain in June, 1812. The successes of the British were but few and trifling, while the American navy triumphed in a series of brilliant exploits, and the gallant defence of New Orleans by Gen. Andrew Jackson, crowned the American arms with laurels. Peace was concluded at Ghent, December 24, 1814.

The next great event of national importance was the war with Mexico. What is now known as Texas was claimed by that country. The territory was sparsely settled, mainly by adventurers from the Southern States. In 1836 Texas revolted from Mexico and established a Republic. In 1845 Texas was annexed or re-annexed to the United States and admitted as a State. A dispute with Mexico at once arose as to its Western boundary and war followed, the Union forces being commanded by Gen. Zachary Taylor and Gen. Winfield Scott. The war resulted disastrously to the Mexicans under Gen. Santa Anna, and a treaty of peace was concluded in 1848.

The Irrepressible Conflict.

The subject of slavery created a growing agitation throughout the country, which resulted in the formation of the Republican party in 1856, with Col. John C. Fremont as its candidate for the Presidency. It sprang rapidly into power, but failed to obtain a majority of the votes of the Electoral College. The agitation of the subject of slavery continued with great vigor and bitterness. Upon the election of Abraham Lincoln as President in 1860, eleven of the Southern States seceded and formed an independent government.

The people of the North resisted the dismemberment of the Union and the great Civil War followed. In January, 1863, President Lincoln, by proclamation declared the slaves in the part of the South then in rebellion, free. The character of the struggle was at once changed in the eyes of foreigners, and the sympathy of the outside world turned gradually to the North. The struggle between the North and the South was one of vast magnitude. Sanguinary battles were fought on land and water. At length the Federal forces, under Gen. Ulysses S. Grant, were victorious, and on April 9 1865, the Confederate army, under Gen. Robert E. Lee, surrendered at Appomattox Court House, Va.

On April 15, 1865, President Lincoln was assassinated at Washington, and an attempt

was made upon the life of Mr. Seward, Secretary of State. The war had cost the nation some $10,000,000,000.

The seceded States were again taken into the Union on conditions contained in the 13th, 14th and 15th amendments to the Constitution, abolishing slavery, and giving the negro the right to vote. In 1867 the United States purchased Alaska from Russia. In 1884 the Democratic party reorganized and elected its candidate, Mr. Cleveland, over Mr. Blaine. In 1888 the Democrats made the campaign on the basis of a reformed tariff. The Republicans won, Mr. Harrison becoming President, and by passing what are known as the McKinley Bill and the Administrative Bill reformed the tariff in the directive of protection to American industries.

Result of Election.

In 1890 a House of Representatives overwhelmingly Democratic was elected.

In 1892 the election resulted in the return of the Democratic candidate, Mr. Cleveland, by a large majority over Mr. Harrison. Mr. Cleveland was inaugurated on March 4, 1893.

On the first of May following, the World's Fair was opened at Chicago, the object of which was to commemorate the discovery of America by Columbus.

The elections of November, 1894, resulted in Republican victories all over the Union.

The Presidential campaign of 1896, which was one of unusual excitement on account of the monetary questions involved, resulted in the election of Hon. William McKinley as President and Hon. Garret A. Hobart as Vice-President, the former of Ohio and the latter of New Jersey. Mr. McKinley was inaugurated March 4, 1897.

The insurrection which broke out in Cuba in 1895 continued, and was a subject of grave consideration by our Government. On the 15th of February, 1898, the United States battleship Maine was destroyed in the harbor of Havana, resulting in the death of 266 officers and men. This unfortunate incident had much to do in precipitating the war with Spain, which was declared by the United States, April 21, 1898.

The coast of Cuba was at once blockaded by the North Atlantic squadron. On May 1st, the United States Asiatic fleet, under Admiral Dewey, destroyed the Spanish squadron in the harbor of Manila, gaining thereby a great naval victory.

Thrilling Events.

An attack on Santiago de Cuba by United States troops under command of General Shafter resulted in the capture of that city in the early part of July. On the 3rd of the same month the Spanish squadron, under Admiral Cervera, attempted to escape from the harbor of Santiago and was totally destroyed by the United States fleet. A treaty of peace between Spain and the United States followed.

Prince Henry, brother of Emperor William of Germany, visited the United States in Feb. 1902; he was cordially received.

On September 8, 1900, Galveston, Texas, was visited by a storm which swept the sea over the city and resulted in the loss of nearly 5000 lives.

President McKinley was assassinated at the Pan-American Exposition at Buffalo, on September 6, 1901, by Leon Czolgosz, an Anarchist. He died September 14, and was buried on the 19th at Canton, Ohio, amidst an unparalleled demonstration of public sorrow. Vice-President Roosevelt became President.

The Star-Spangled Banner

O! say, can ye see by the dawn's early light
What so proudly we hail'd by the twilight! last gleaming?
Whose bright stars & broad stripes, through the clouds of the fight
O'er the ramparts we watch'd were so gallantly streaming
And the rockets red glare, the bomb bursting in air
Gave proof through the night that our flag was still there
O! say does that Star-Spangled Banner yet wave
O'er the land of the free & the home of the brave?

On that shore, dimly seen through the mists of the deep,
Where the foe's haughty host in dread silence reposes.
What is that which the breeze, o'er the towering steep
As it fitfully blows, half-conceals, half-discloses?
Now it catches the gleam of the morning's first beam,
In full glory reflected now shines on the stream.
'Tis the Star-Spangled Banner - O! long may it wave
O'er the land of the free & the home of the brave

And where is that band who so vauntingly swore
That the havoc of war & the battle's confusion
A home & a country should leave us no more?
Their blood has wash'd out their foul footstep's pollution
No refuge could save the hireling & slave
From the terror of flight or the gloom of the grave
And the Star-Spangled Banner in triumph doth wave
O'er the land of the free & the home of the brave.

O! thus be it ever when freemen shall stand
Between their loved homes & the war's desolation.
Blest with victory & peace may the heav'n rescued land
Praise the Power that hath made & preserved us a nation
Then conquer we must - when our cause it is just,
And this be our motto - In God is our trust -
And the Star-Spangled Banner in triumph shall wave
O'er the land of the free and the home of the brave.

Washington,
Oct 21 — 40

F. S. Key

FAC-SIMILE OF THE ORIGINAL COPY OF THE STAR-SPANGLED BANNER.

America.

My country, 'tis of thee, Sweet land of liberty,
Of thee I sing;
Land where my fathers died, Land of the pilgrims' pride,
From every mountain side
Let freedom ring.

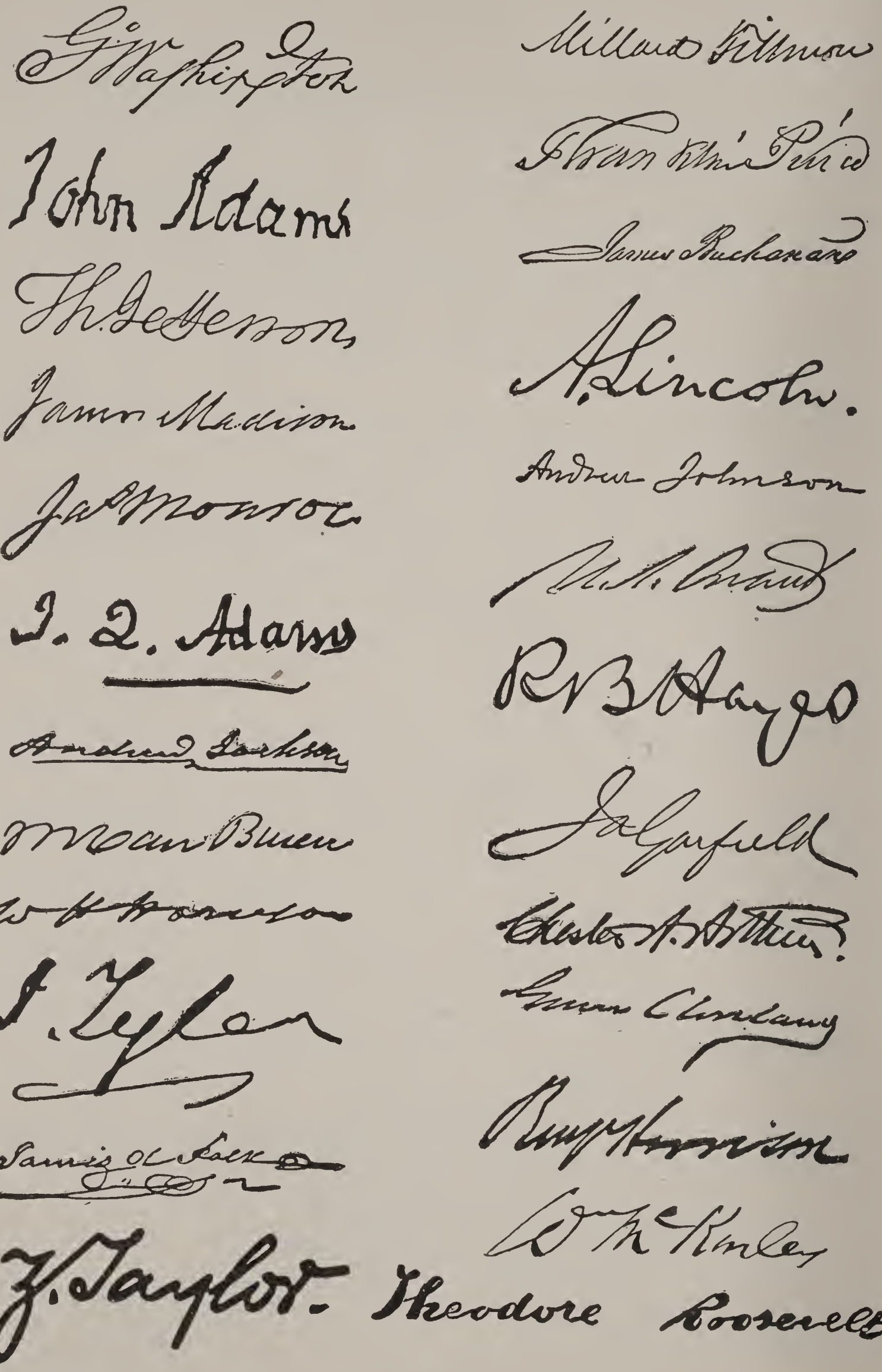
Thy native country, - thee, Land of the noble, free, -
Thy name I love;
I love thy rocks and rills, Thy woods and templed hills,
My heart with rapture thrills
Like that above.

Let music swell the breeze, And ring from all the trees
Sweet freedom's song;
Let mortal tongues awake, Let all that breathe partake.
Let rocks their silence break, -
The sound prolong.

Our fathers' God, - to Thee, Author of liberty,
To Thee we sing;
Long may our land be bright With freedom's holy light;
Protect us by thy might,
Great God, our King.

1832—1892. S. F. Smith

FAC-SIMILE OF THE ORIGINAL COPY OF OUR NATIONAL HYMN.



AUTOGRAPHS OF THE PRESIDENTS



GREAT SEAL OF THE UNITED STATES.



COAT-OF-ARMS OF VIRGINIA.



COAT-OF-ARMS OF NEW YORK.



COAT-OF-ARMS OF MASSACHUSETTS.



COAT-OF-ARMS OF MARYLAND.



COAT-OF-ARMS OF NEW JERSEY.



COAT-OF-ARMS OF NEW HAMPSHIRE.



COAT-OF-ARMS OF DELAWARE.



COAT-OF-ARMS OF CONNECTICUT.



COAT-OF-ARMS OF RHODE ISLAND.



COAT-OF-ARMS OF PENNSYLVANIA.



COAT-OF-ARMS OF NORTH CAROLINA.



COAT-OF-ARMS OF SOUTH CAROLINA.



COAT-OF-ARMS OF GEORGIA.



COAT-OF-ARMS OF VERMONT.



COAT-OF-ARMS OF KENTUCKY.



COAT-OF-ARMS OF TENNESSEE.



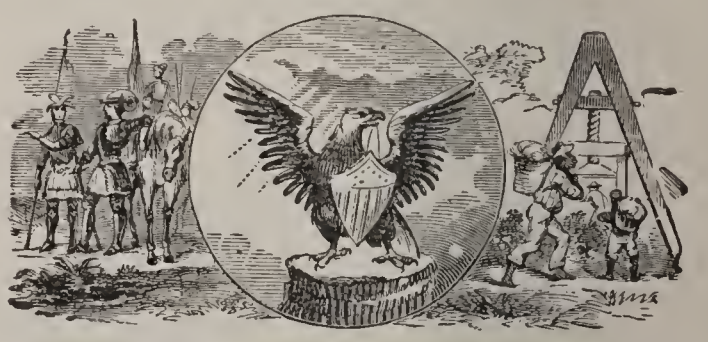
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COAT-OF-ARMS OF LOUISANA.



COAT-OF-ARMS OF INDIANA.



COAT-OF-ARMS OF MISSISSIPPI.



COAT-OF-ARMS OF ILLINOIS.



COAT-OF-ARMS OF ALABAMA.



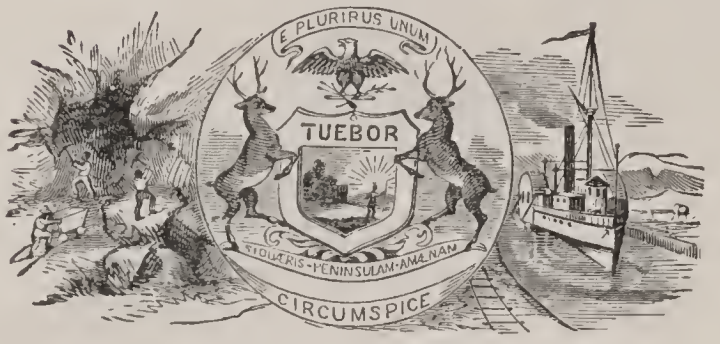
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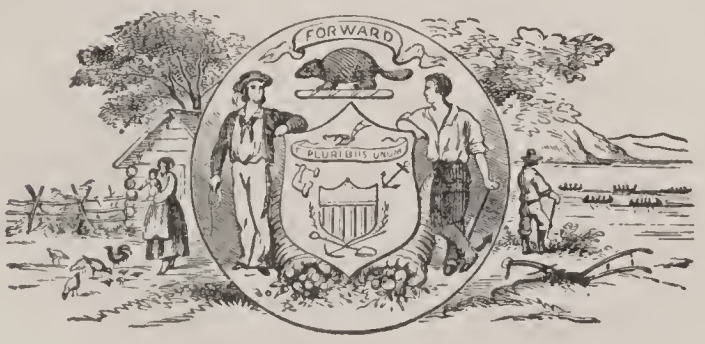
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COAT-OF-ARMS OF FLORIDA.



COAT-OF-ARMS OF TEXAS.



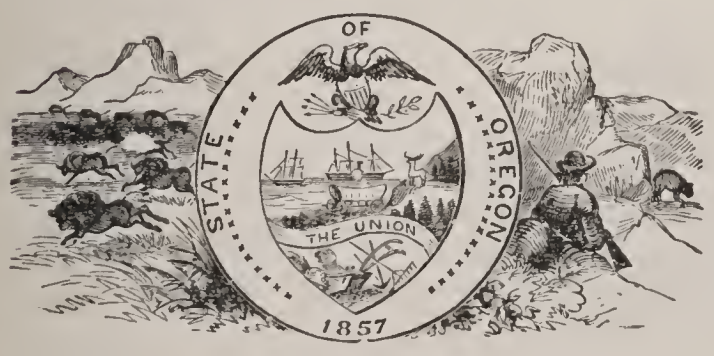
COAT-OF-ARMS OF WISCONSIN.



COAT-OF-ARMS OF CALIFORNIA.



COAT-OF-ARMS OF MINNESOTA.



COAT-OF-ARMS OF OREGON.



COAT-OF-ARMS OF KANSAS.



COAT-OF-ARMS OF WEST VIRGINIA.



COAT-OF-ARMS OF UTAH.



COAT-OF-ARMS OF NEBRASKA.



COAT-OF-ARMS OF NEVADA.



COAT-OF-ARMS OF MONTANA.



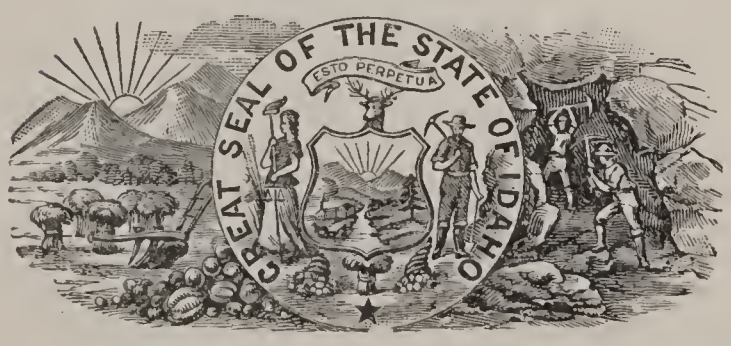
COAT-OF-ARMS OF COLORADO.



COAT-OF-ARMS OF SOUTH DAKOTA.



COAT-OF-ARMS OF NORTH DAKOTA.



COAT-OF-ARMS OF IDAHO.



COAT-OF-ARMS OF WASHINGTON.



COAT-OF-ARMS OF WYOMING.

THE DOMINION OF CANADA

IN 1534 Jacques Cartier, a French navigator, a native of St. Malo, set out from that port with two small vessels of twenty tons each, landed on the shores of Gaspe (now part of the province of Quebec), and took possession of the country in the name of his sovereign, Francis I. He went again in the following year (1535), passed up the gulf and river, which he named the St. Lawrence, and reached Stadacone, the site of the present city of Quebec. Continuing his voyage, he arrived at Hochelago, another Indian town, and gave it the name of Mont Royal, since corrupted into Montreal.

After passing the winter at Stadacone, he returned to France. But little or nothing was done to promote the colonization of the country until 1608, when Samuel de Champlain, a Frenchman of gentle birth, maritime and military experience, and much religious enthusiasm, visited Canada for the third time, with the object of extending Christianity and developing trade and commerce, and founded the city of Quebec, the name of which is said to be derived from an Indian word kebec, "the rock."

The control of the immense region, extending eastward to Acadia (Nova Scotia), westward to Lake Superior, and down the Mississippi as far as the Gulf of Mexico, was from this time until 1763 claimed by France. Recollet and Jesuit missionaries traversed it in all directions, suffering great hardships in their endeavors to convert the Indians. Their work was watched with much enthusiasm in France, and it is admitted that they were the first explorers of the country and the pioneers of civilization in the Far West.

The claims of France were not, however, undisputed, as is shown by the grant of a charter in 1670 by Charles II to Prince Rupert and his company, known ever since as the Hudson Bay Company of the exclusive right of trading in the territory watered by streams flowing into Hudson Bay. As already mentioned, they gave up their exclusive rights in 1869 on certain conditions, among others, a money payment of £300,000 and a large grant of land.

Long and Bitter Struggle.

The struggle between Great Britain and France for supremacy in North America was long and bitter, but it terminated finally in 1763 by the cession to the former under the Treaty of Paris of Canada with all its dependencies, except the Islands of St. Pierre and Miquelon, which were retained as fishing stations, not to be fortified or garrisoned. Hudson Bay with the adjacent territory, Nova Scotia and Newfoundland had been previously transferred to England by the Treaty of Utrecht in 1713. The population of Canada in 1763 was about 70,000, of Nova Scotia, 8000.

No time was lost in attempting to adapt British institutions to the new possession; but considerable friction occurred for some years, and it was not altogether allayed by the passing in 1774 of what is known as the Quebec Act. This gave the French-Cana-

dians the free exercise of their religion, and secured their civil rights, laws and customs. It annexed large territories to Quebec, including that part of the United States now forming Minnesota, Wisconsin, Michigan, Ohio, Indiana and Illinois, which passed from Great Britain in 1783.

Quebec was eventually in 1791 divided into Upper and Lower Canada; but this did not prove satisfactory in either province, leading to conflicts between the popular and elected assemblies and the nominated or official councils, and ultimately to the unsuccessful rebellion in 1837-38.

The representatives from each province in the united parliament were equal in number. Upper Canada, however, made greater progress than Lower Canada (the population in 1851 was 952,004 and 890,261 respectively, and in 1861, 1,396,061 and 1,111,566), and agitated for an additional number of members and claimed other concessions, but the demands were always opposed by the latter. The consequence was frequent legislative deadlocks and continual difficulties. Such was the state of things in 1864.

It is now necessary to refer to the other colonies on the Atlantic and Pacific coasts.



UNIVERSITY OF TORONTO.

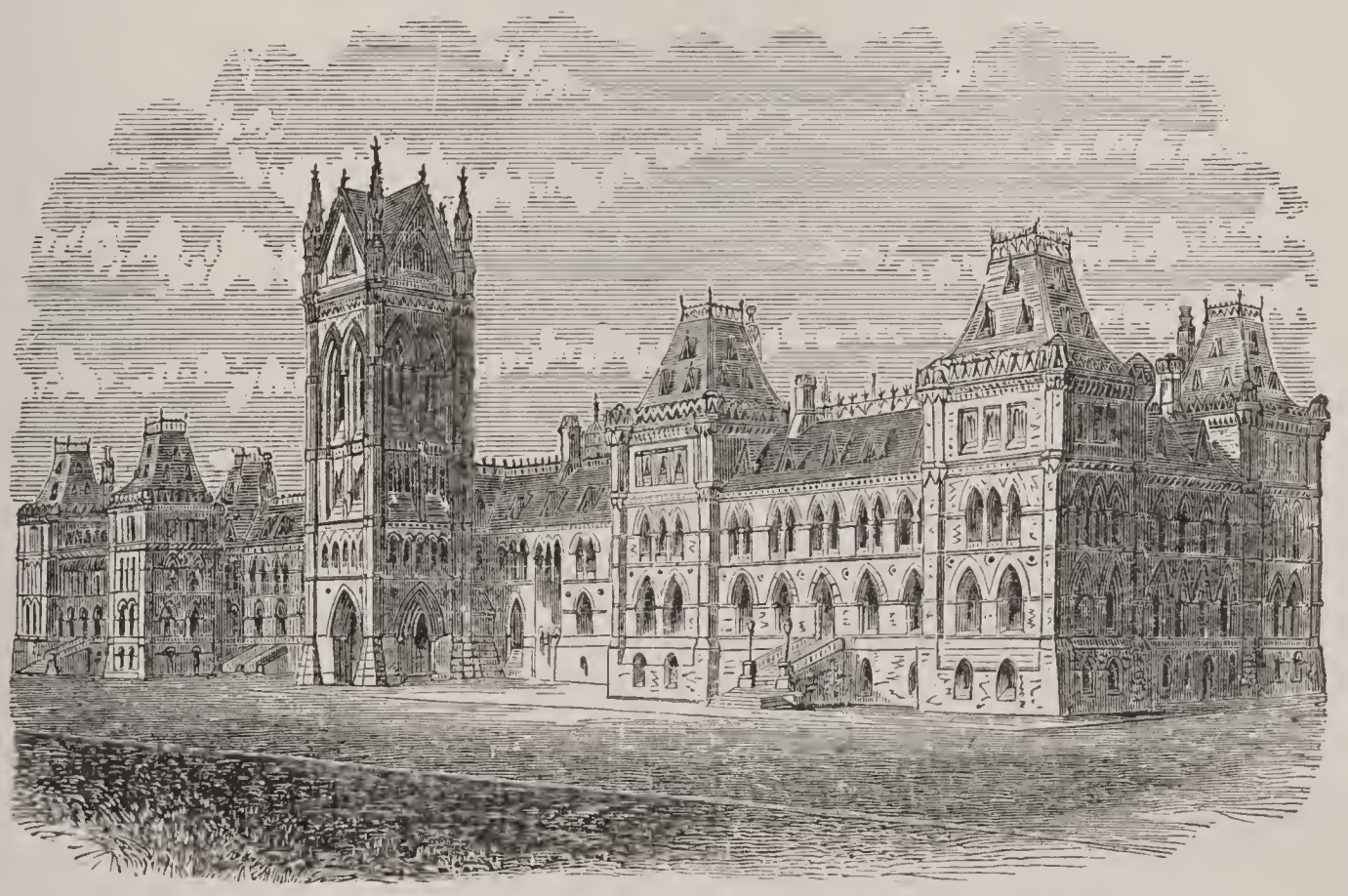
In accordance with Lord Durham's recommendations, the two provinces were reunited in 1840 (population of Upper Canada, 450,000; of Lower Canada, 650,000), but the union was not a success politically, although it indirectly led to the great confederation in 1867. It should be mentioned that the inhabitants of Upper Canada consisted largely of United Empire loyalists, who remained loyal to British institutions, and who left the United States at the close of the War of Independence, while those of Lower Canada were almost exclusively French-Canadians.

In 1770 St. John Island (renamed Prince Edward Island in 1780), and in 1784 New Brunswick, were formed out of Nova Scotia into separate colonies. In 1858, owing to the rush for gold and the influx of population, British Columbia was make a crown colony, and in 1866 Vancouver Island was joined to it. In 1864 the maritime provinces were discussing the desirability of local confederation, and advantage of the opportunity was taken by Canada to propose a broader scheme to cover all British North America, and after several confer-

ences a basis of union was agreed upon which resulted in the formation of the Dominion.

Since the confederation of the provinces, the chief events have been as follows: The Red River Rebellion, which collapsed in August, 1870; treaty of Washington, 1871, dealing with fisheries and the mutual use of certain canals; outbreak of half-breeds under Louis Riel in March, 1885, resulting in the speedy suppression of the rebellion and Riel's execution; and the treaty for the settlement of the fisheries dispute, signed by the British and corruption were made in Newfoundland during the same year and the ministry was compelled to resign, April 11. Much excitement was caused throughout the country on account of the Manitoba school question involving the sectarian issue; judgment was pronounced in favor of the minority, February 6, 1895. This was followed by a remedial order which was adopted by the Cabinet Council, March 19.

After a heated campaign the New Brunswick elections resulted in a complete victory for the government, by a vote of 35 to 8,



PARLIAMENT HOUSE, OTTAWA.

and United States representatives February 15, 1888. Sir John MacDonald died June 7, 1891, his funeral being attended by a vast concourse of people. In October the Dominion Government refused to acquiesce in the copyright treaty between England and the United States, claiming that the treaty was not international.

The voting in Ontario on the Prohibition Plebiscite resulted in a prohibition majority of 81,769. This was in 1894 and shows the widespread agitation at this time upon the question of temperance. Charges of bribery

October 17, 1895. Canada exports chiefly coal, gold, copper, iron, phosphates, salt, mineral oils and gypsum. Gold mines are worked in Nova Scotia and other parts of the country. The fisheries, as regards the area of water available, are the largest in the world. A bounty is offered by the government for the vessels making the largest catch. The canal and river improvements have cost large sums of money and are works of great utility and importance. English is generally spoken in the Dominion, but in some parts of the province of Quebec

French is the only language understood. In the Dominion, Quebec and Manitoba Parliaments, members may address the House in either language. In Quebec province the speeches are usually in French, which seems to retain a strong hold upon the people.

MEXICO

WHEN the Spaniards, under Cortez, commenced the conquest of Mexico in 1519, they found the native Indians far advanced in civilization, wealthy and hospitable. They had some knowledge of art and architecture, and some ideas of civilized life. They had an instinctive dread of the foreigners, and yet treated them with kindness. The country continued under the jurisdiction of a Spanish viceroy, until it declared itself independent in 1820, and has so continued to the present time.

In 1825 a treaty of commerce was formed with Great Britain. The expulsion of the Spaniards was decreed in 1829, and a Spanish expedition against Mexico was unsuccessful. On the 11th of May, 1833, after a revolution such as have been common in Mexico, Santa Ann was made President. This resulted in the independence of Mexico,



ENTRY OF THE FRENCH INTO THE CITY OF MEXICO.

which was recognized by Brazil in 1830 and by Spain in 1836.

In 1845 occurred the war between Mexico and the United States respecting the possession of Texas, and the Americans having been victorious, a treaty of peace was ratified May 19, 1848. Since this time there has been no rupture of peaceful relations between the two countries.

In 1863 an assembly of notables at the city of Mexico decided on the establishment of a limited hereditary monarchy, with a Roman Catholic Prince as Emperor, and offered the crown to the Achduke Maximilian of Austria. The attempt, aided by the French, proved unsuccessful, and after a condition amounting to civil war, the Republican element of Mexico was successful, and Maximilian was seized and shot, June 19, 1867. The city of Mexico which was held by the monarchial party was taken by the opposing forces after a siege of sixty-seven days, and the Republic was re-established.

During the same year the Mexican Congress assembled, Jaurez acting as provisional president; he was re-elected in December of the same year. A series of insurrections followed through the efforts of different parties to obtain control of the government. The insurgent Diaz defeated the government troops, entered the city of Mexico and assumed power as provisional president in November, 1876. Diaz retained the presidency of the Republic, and continued his administration.

Mexico is rich in mines and is a large exporter of coffee and tobacco. In addition to these, the chief agricultural products are maize, barley, wheat, beans, cotton, sugar cane, rice, cocoa and vanilla. Large numbers of cattle are reared in Mexico for the United States and other countries.

ENGLAND

IT is a well-known fact of history that the western part of England was known to the Phœnicians, and was resorted to by them for its tin, about four centuries B. C.; hence the whole country received the name of the *Cassiterrides* ("Tin Islands"). When invaded by Cæsar, B. C. 55, it was called *Britain*, or sometimes *Albion*. The Romans subdued all England, and some parts of Scotland and Wales, but did not reach Ireland. though its existence was known to them.

In the third century of the Christian era, adventurers from the opposite coasts of Germany settled in various parts, and joined with the Britons in forcing the Romans to abandon the Island, A. D. 410, after a rule of about 400 years, traces of which still remain in every quarter. The Britons, being divided into as many hostile states as they had cities, were unable to resist the fresh hordes (now called *Saxons* and *Angles*) that poured into the island, and about 459 the kingdom of Kent was founded.

The Britons still fought stubbornly, but

were gradually driven westward, and by the year 584 the kingdom of Mercia was established, being the last of the seven kingdoms founded by the invaders, whence the name of the *Heptarchy*. In 827, Egbert, king of Wessex, obtained the supremacy over his rivals, and declared himself King of England.



BATTLE OF HASTINGS—DEATH OF HAROLD.

His descendants, of whom Alfred the Great was the most illustrious, held the throne for more than 200 years, but the country suffered greatly during the time from the ravages of the Danes, who, under Canute and his sons, became its ruler for 25 years (1017–1042). The Saxon line was restored in the person of Edward the Confessor, to whom Harold succeeded; but his death in the battle of Hastings, 1066, gave England into the hands of the Norman kings, who reigned from 1066 to 1154.

Then came the Plantagenets (1154–1485); the Tudors (1485–1603); and the Stuarts (1603–1714), to whom the House of Brunswick succeeded on the death of Queen Anne. The conquest of Ireland was begun in the year 1170, but can hardly be regarded as completed till the surrender of Limerick in 1691. Wales was conquered by Edward I. in 1282, and formally annexed to England by Henry VIII. in 1536.

Alliance with France.

Scotland successfully resisted the efforts of Edward I. to subjugate it, maintained for ages a close alliance with France, and in 1603 gave a ruler to England in the person of James VI., who became James I. of Great Britain, a title then first assumed. This was but a personal union, but the political union of the two kingdoms was effected under Queen Anne in 1707. Ireland which had been hitherto only styled a lordship, was declared a kingdom in 1542, and this kingdom declared a member of the triple monarchy of Great Britain and Ireland by the Act of Union, 1801.

Early in the present century there was a determined and successful effort by the Irish Catholics to obtain religious emancipation. At length the leaders of the Whig party made common cause with the classes hitherto excluded from government, and backed at once by the traders and artisans, forced upon an unwilling Parliament the Great Reform Bill of 1832, which marked an important epoch in English history.

From this time there has been a marked change both in the position of England and in the character of the questions which have excited public interest. Still mistress of the sea, and possessed through its colonies of an empire distributed in every corner of the globe, England has found enough to do in the preservation and improvement of this gigantic dominion, and has as far as possible abstained from interference in continental quarrels.

Vast Power and Influence.

Once and again it has shown its influence. In 1848, the year of revolutions, and in the subsequent consolidation of Italy, its sympathies were not hidden, but there was no thought of active interference. It allowed the great American Republic to settle its disputes uninterrupted, save by sympathy at first shown to the South. It adopted the same attitude of non-intervention in the Prussian wars against Denmark, against Austria and against France. It has only been in questions which seemed to touch the safety of its eastern empire that it has drawn the sword.

The Crimean War was avowedly for the maintenance of Turkey as a check upon Russia, which was threatening the road to India. Of the same class have been the wars in Egypt and Afghanistan. Still more directly when India itself burst into insurrection was England called upon to interfere and engage in the victorious but terrible campaigns which marked the suppression of the mutiny. The other wars, and they are not few, have all been connected with mercantile and colonial interests. The questions which have chiefly moved men's minds have been of a social or mercantile character.

The extension of the electoral franchise, the reform of municipalities, the repeal of the corn laws, the establishment of free trade, the improvement of the condition of the working classes, the regulation of strikes and trades-unions, a national system of education, and of late years the question of the managment of Ireland, have been the points round which political interest has centred. They are the fitting questions to occupy a democracy. To that phase of political life in one way or other England is fast hastening.

It has still to be seen whether under such conditions means will be found to keep together those colonies which are already to all intents and purposes independent, and to preserve to the empire the magnificent position which the gradual development of physical and political forces has secured.

Table of Kings and Queens of England.

	Began to Reign.
NORMAN LINE.	
William I.	October 14, 1066
William II.	September 9, 1087
Henry I.	August 2, 1100
Stephen	December 2, 1135
FAMILY OF PLANTAGENET.	
Henry II.	October 25, 1154
Richard I.	July 6, 1189
John	April 6, 1199
Henry III.	October 19, 1216
Edward I.	November 16, 1272
Edward II.	July 7, 1307
Edward III.	January 24, 1326
Richard II.	June 21, 1377
HOUSE OF LANCASTER.	
Henry IV	September 29, 1399
Henry V.	March 23, 1413
Henry VI.	August 31, 1422
HOUSE OF YORK.	
Edward IV.	March 1, 1461
Edward V.	April 9, 1483
Richard III.	June 22, 1483
YORK AND LANCASTER UNITED IN THE HOUSE OF TUDOR.	
Henry VII. of Lan.	August 22, 1485
Henry VIII.	April 22, 1509

Edward VI	January 28, 1547
Mary I	July 6, 1553
Elizabeth	November 17, 1558

HOUSE OF STUART.

James I	March 24, 1603
Charles I	March 27, 1625
Cromwell, Protector	From 1649 to 1660
Charles II	January 30, 1660
James II	February 6, 1685
William and Mary	February 13, 1689
William alone	from December 28, 1694
Anne	March 8, 1702

BRUNSWICK FAMILY.

George I	August 1, 1714
George II	June 11, 1727
George III	October 25, 1760
George IV	January 29, 1820
William IV	June 26, 1830
Victoria	June 20, 1837
Edward VII	January 22, 1901

SCOTLAND

FROM historic records it appears that the first inhabitants of Scotland were Celts, and probably were the same as the early Britons, Welsh and Irish. They defended themselves against the Romans, who could never subdue the people of the Highlands. They were so troublesome that the Roman generals caused a wall to be built from the Solway Firth to the river Tyne.

Thus the Scots were shut up in their own country, like a herd of unruly cattle; but they contrived to get over the wall pretty often. In three or four hundred years after Christ a tribe of Goths, called Picts, came over from the continent and settled in the country. These inhabited the Lowlands, and lived by agriculture. The Scots dwelt in the mountains, carrying on war, and subsisting by the chase.

Thus the nation become divided into Highlanders and Lowlanders, and thus, to some extent, the people remain to this day. They live peaceably now, but in early days they quarreled fiercely. In 839, it is said that Kenneth II., who was a Highland leader, subdued the Picts, and became first king of all Scotland. From this time to Edward I. of England, there was a constant change of sovereigns. Edward Longshanks, the same that subdued Wales, made war upon the Scotch, imprisoned Wallace, and had prepared a great army for the final subjugation of Scotland, when he died. Edward II., was beaten by Robert Bruce at the glorious battle of Bannockburn. This event occurred in 1313, and secured the freedom of Scotland, which had been threatened by the English kings.

Incessant Warfare.

From this time the history of Scotland tells of little but civil wars and bloody battles with England, till the time of James V. He assumed the reins of government in 1513, at the age of eighteen months. He afterwards lost the confidence of his army, and they deserted him in the hour of need. This broke his heart, and he starved himself to death in 1542 at the age of thirty-one.

His daughter was the beautiful and un-

fortunate Mary Queen of Scots, as she is called, and who was educated in France, and was not only very handsome, but very accomplished. While she was yet a young lady she was taken to Scotland and became queen. But beauty, accomplishments and power, cannot insure happiness. Mary's kingdom was in a state of great trouble; the people were divided among themselves, and Mary found it impossible to govern them. At length she became afraid that they would kill her, and, to save her life, she went to England and placed herself under the protection of Elizabeth, who caused her to be put in prison, and finally took her life, thus ending her many misfortunes.

The son of Mary, James VI. of Scotland, succeeded his mother, and after the death of Elizabeth he became King of England also, under the title of James I. Though he lived in England he did not forget Scotland. He loved learning and caused schools to be established in his native country. These schools are continued to this day, and therefore it is very uncommon to meet with a Scotchman who is wholly uneducated.

From the time of King James, in 1603, Scotland has been attached to the British crown. She has sometimes rebelled, and in the cause of the Stuarts she fought a good many battles. But Scotland has long been a peaceful portion of the British kingdom.

IRELAND

THE origin of the ancient Irish race is involved in much obscurity; ethnologists, however, generally agree in describing it as belonging to the old Brito-Celtic stock. Under the name of *Scoti*, they became known to the Romans by their incursions upon Britain. In the third century A. D., through the supposed influence of St. Patrick, the natives of the island became Christianized, and by the sixth, learning and civilization had become largely diffused throughout its limits.

In 1014 A. D., the Danish invaders were overthrown by King Brian Boru in the battle of Clontarf. In 1155, Pope Adrian IV. granted Ireland, by special bull, to Henry II. of England, and the island received shortly afterward a permanent English colonization. In 1210 King John granted a Charter to the Irish, which received confirmation at the hands of his son, Henry III.

In the sixteenth century, Henry VIII. introduced the Reformed Faith, and assumed the title of *King of Ireland*. Under James I. the province of Ulster received a large immigration of Scottish and English settlers, who introduced Presbyterianism. In 1641, the Catholic population raised a formidable revolt against the English Protestants, 40,000 of whom were killed in Ulster alone.

Anarchy continued to prevail till 1649, when the English republican, Cromwell, crushed it out with a hand of iron. In 1688, the Irish people—except the Ulster Protest

ants—espoused the cause of James II.—a cause extinguished by the defeats of Boyne and Aughrim.

In 1798, the Irish Catholics again rose in revolt, and received some trifling aid from France; this insurrection ended in their being more firmly riveted to England than before. In 1800, the Irish Parliament voted the legislative union of Ireland with England; in 1829, the Catholic Emancipation Bill passed the Imperial Parliament; in 1848, a so-called "manifesto" of the "Young Ireland party" provoked an unsuccessful attempt at insurrection under William Smith O'Brien and others; and since then the *Fenians, Home Rulers, Land Leaguers* and other modern partisans of Irish Independence have been a cause of anxiety and trouble to the British Government.

The government is semi-independent, an English viceroy, under the title of *Lord Lieutenant*, holding almost regal sway. The Roman Catholic is the prevailing form of religion, excepting in Ulster, in which province Presbyterianism is largely in the ascendant. In 1870, the Anglican Church in Ireland, heretofore based on a similar foundation to that which it holds in the sister-kingdom, was disestablished by Act of Parliament, and all churches therefore made self-supporting.

Ireland is well supplied with educational institutions, having three universities—those of Trinity College, Dublin (Protestant), Maynooth (Roman Catholic), and the Queen's University—besides a large number of endowed schools, and an admirable system of mixed schools where children of all denominations may be taught. The legal executive is similar to that of England.

FRANCE

BEFORE the time of Cæsar, the whole of France was known to the Romans under the name of *Transalpine Gaul;* but after its conquest it was divided into the four provinces of *Provincia Romanorum* (Provence), *Gallia, Aquitanica, Celtica* and *Belgica.* In the fifth century the Germanic nations began to pour in an irresistible torrent over Gaul; but the Franks, in course of time, absorbed all the other tribes of that country, and Pharamond, their chief, in 420, is considered the founder of the French monarchy.

In 751 the Carlovingian dynasty, commenced in the person of Pepin le Bref, was carried to the zenith of its power and glory by Charlemagne, 768-814, and ended with Louis V. in 987. The Capetian race gave fifteen kings to France, beginning with Hugh Capet and ending with Charles V., 1328.

The house of Valois ruled France under thirteen kings, beginning with Philip VI. and ending with Henri III., 1589. In that year Henri IV. inaugurated the House of Bourbon. Louis XIII. succeeded in 1610; Louis XIV. in 1643; Louis XV. in 1715; and Louis XVI. in 1774.

In 1789, broke out that tremendous revolution which cost Louis XVI. his crown and head (1793), destroyed every vestige of the previous government and institutions, and inaugurated an era of periodical convulsions, which, unhappily for this country does not yet seem to have terminated.

Downfall of Napoleon.

The power was successively held by the Convention, 1792; the Directory, 1795; the Consulate, 1799; Napoleon I., who caused himself to be crowned emperor, 1804, and whose downfall dates from the great battle of Waterloo, 1815; Louis XVIII., the representative of the House of Bourbon, who was then restored to the throne by the aid of the Allied Powers; Charles X., who succeeded the latter in 1824; Louis Philippe I., of the Orleans branch of the Bourbons, who was raised to the throne after the revolution of July, 1830; the Second Republic, inaugurated after the overthrow of the last-named monarch in 1848; and Napoleon III., who, after the *coup d'etat* of 1851, was elected emperor.

In July, 1870, the latter declared war against Prussia; his armies were defeated in several battles, and himself compelled to surrender to the victorious enemy after the decisive battle gained by them before Sedan in September; and his dethronement was decreed by the French Assembly. The war was then unsuccessfully renewed by the Republican Government of National Defence; Paris, besieged by the Germans, resisted heroically its invaders for several months, but on the eve of being obliged to capitulate by sheer starvation, negotiations were entered into which resulted, in February, 1871, in a disastrous treaty of peace with Germany, by which France lost the portions of her territory included in Alsace-Lorraine, and had also to pay the enormous sum of $1,000,000,000 by way of indemnity, which indemnity, however, was paid in full much in advance of the stipulated period.

In March, 1871, a revolt broke out in Paris, headed by the leaders of the extreme Republican party, in conjunction with the Socialists. Under the name of the *Commune*, they inaugurated a dictatorial power in the French capital, and resisted the authority of the National Assembly; hence necessitating a second siege, more calamitous than the first

Presidents of the Republic.

On August 31, 1871, M. Louis Adolphe Thiers was nominated by the National Assembly President of the French Republic. In 1873 (May 24) he was suceeeded by Marshal MacMahon, and in 1879 by M. Grévy, who resigned in 1887, and was succeeded by M. Carnot.

On the 23d of June, 1894, President Carnot was assassinated at Lyons by an Anarchist. M. Cassimer Perier was elected President June 27th by the National Assembly. In January, 1895, he resigned his office and determined to retire to private life. On the 17th of the same month the Assembly elected as his successor, M. François Felix Faure.

France is notably an agricultural country. The high development of nursery-gardening has achieved most remarkable results in variety and richness of crops. It may suffice to say that, owing to their perfect methods of horticulture, the farmers around Paris and other large cities succeed in obtaining vegetables and fruit to the value of from $300 to $800 per acre. The planting of trees and the reclamation of unproductive soil go on in various parts of France on a large scale. Special interest is taken in cattle-raising, and

fine breeds of horses are reared in the North and Northwest. In some parts of the country wool-growing is an extensive industry. The exports of cattle, butter, eggs, cheese and poultry, especially to England, are very considerable—no less than 70,000,000 pounds of butter and 1,000,000,000 eggs being sent every year across the channel.

France is very rich in all kinds of building stone, gravel, chalk and plaster, and this circumstance has permitted her to build most of her cities of excellent stone.

THE GERMAN EMPIRE

FROM all that can be collected of the early history of Germany (called *Germania* by the Romans), it appears to have been divided into many petty nations and principalities, many of which frequently united under one head or general, both in their offensive and defensive wars. The Germans maintained a long and aggressive warfare against the Romans, but were at length kept in check by Germanicus.

The Romans, nevertheless, prudently contented themselves by making the Rhine and the Danube the boundaries of their conquests; they accordingly built fortresses on the banks of both those rivers, to prevent the incursions of what they termed the barbarous nations; but within about a century after Constantine the Great, the Franks, Burgundians, Alemanni, and other German nations, broke through those boundaries, and dispossessed the Romans of all Gaul, Rhætia and Noricum, which they shared among themselves; but the Franks prevailing over the rest, at length established their empire over all modern Germany, France and Italy, under the conduct of Charlemagne.

At the demise of this great monarch, Germany became again dissolved into constituent states until 843, when the kingdom of Germany arose under the sovereignty of Louis le Debonnaire. After being governed by the Carlovingians till 887, the monarchy became elective in 911, in the person of Conrad I., Duke of Franconia; a Saxon dynasty succeeded in 918, and afterward resuscitated the empire under Otho the Great, under the title of the *Holy Roman Empire of the German Nation.*

The Throne at Last Established.

Under the Suabian dynasty, 1138-1190, the imperial power attained its zenith. Then came the aggressions of the Popes, the feuds of the great vassals of the crown, and the state of anarchy consequent upon the struggle between the Guelphs and the Ghibellines, succeeded by an interregnum lasting from 1254 to 1273. In the latter year the empire became reconsolidated by Rudolph of Hapsburg, and the throne first placed upon a firm basis.

In 1438, the House of Austria commenced its long career as Emperor of Germany, and reached its acme of power and prosperity under Charles V. and his immediate successors. The Thirty Years' War, 1618–48, then supervened to disintegrate the empire, establish the Lutheran religion, and give to France the political ascendancy on the continent of Europe. For several



CHARLEMAGNE AND HIS NOBLES.

after generations, wars with the last-named power culminated, in 1740, in the War of the Austrian Succession, which raised the House of Lorraine to the imperial throne in the person of Francis I.

At length, in 1804, the ancient German empire came to an end, beneath the blows of Napoleon I., by the abdication of Francis II., who, retaining only his hereditary territories, became the first Emperor of Austria. Ages anterior to this consummation, Germany had been politically transformed (so to speak) by the great princes, vassals of the empire, into a semi-independent confederacy of petty states, represented in the diets. The free cities also shared in the distribution of political power, and finally resolved themselves into the Hanseatic League.

The Historic Ten Circles.

Prior to the French Revolution, 1789, the empire had become politically distributed into ten *circles*, each circle embracing the states of one or more powers—regal, ducal, electoral, ecclesiastical or municipal. The provincial diets of these circles were subject (at all events nominally) to the imperial diet convened and presided over by the emperors.

In 1805, Napoleon I., in pursuance of his designs for the disintegration of the German power as a unity, enlisted on his side certain of the circles and electoral powers, which he combined into a body called the *Confederation of the Rhine*. He also created for his brother Joseph a kingdom out of the Lower Rhine provinces, under the name of Westphalia. In 1809, too, he succeeded in absorbing into the French Empire the seaboard provinces of the old regime, and divided them into departments after the French manner. In 1813, however, the *Liberation War* broke out, and terminated in the redemption of the country, and the expulsion of the foreign invaders.

The Congress of Vienna, 1815, divided Germany into thirty-nine sovereign states; which number became by various after causes reduced to thirty-four, at which it stood prior to the Austro-Prussian war of 1866, which eliminated Hanover and several other secondary states from the German political map, and extinguished Austrian influence in Germany proper. Prussia hence became the one recognized ruling power in that country, and assumed the leadership of the states of North Germany, united under the title of the *North German Confederation*.

Grand Military Alliance.

In addition, she further increased her political influence, or rather preponderance, by entering into treaties with the South German powers of Bavaria, Würtemberg and Baden, providing for a strict international military alliance—offensive and defensive—and the placing of the armies of those powers at the disposal of the German nation, as represented by Prussia, in time of war. The practical results of this wise and astute policy bore fruit in the achievements of the united German armies in the campaign against France, 1870–1: and the restoration of national unity, in the rehabilitation of the Germanic Empire of Barbarossa and Charles V. in the person of William I., King of Prussia.

In 1888, a serious illness of Emperor William resulted fatally, March 9th, and his son, Prince Frederick III., came to the throne. His death followed on June 15th, and he was succeeded by his son, Emperor William II. On April 24, 1895, the German Government, in connection with Russia and France, protested against the acquisition of Chinese territory by Japan. On June 19th, the opening of the Baltic Canal was celebrated

by the Germans with the warships of all maritime nations as guests. The occasion called forth congratulations for Germany from many other governments whose representatives participated in the festivities, and was regarded as a peaceful demonstration intended to afford opportunity for the European nations to express their good will.

AUSTRO-HUNGARIAN EMPIRE

TOWARDS the close of the 8th century the Emperor Charlemagne founded a jurisdiction in Lower Austria, which became a duchy in 1156 and an arch-duchy 300 years later. In 1564, Maximillian II., son of the great Emperor Charles V., became Emperor, with Austria, Hungary and Bohemia for his possessions. But many years elapsed before the whole of Austria was united under one government.

In the 18th century it attained rank as one of the great powers of Europe, and up to a recent date its influence was all-powerful in Germany. Until 1806 its rulers bore the title of Emperor of the Romans, but in that year the Emperor Francis renounced that title and became the first Emperor of Austria. From 1806 to 1813 Austria was menaced by the ambitious Napoleon, but made such bitter armed patriotic resistance to the inroads of this almost invincible warrior, that the French victories were shorn of much of their glory. The peace of Vienna (October 14, 1809) took from Austria large possessions.

But these were restored by the Congress of Vienna (1815) after the defeat of Napoleon at Waterloo, together with Lombardy and Venice, the Illyrian provinces, Dalmatia and the Tyrol. The close of the reign of Francis I. was marked by several insurrections amongst the Italian provinces, and it was with the utmost difficulty that the confederation was maintained. The Emperor died in 1835, and was succeeded by his son, Ferdinand I., a weak-minded prince, who entrusted the government almost entirely to Metternich. The French Revolution (1848) caused the Austrian Empire to totter to its foundations. The revolutionary spirit manifested itself everywhere, resulting in the abdication of the Emperor in December, and the imperial honors were conferred upon his nephew, Francis Joseph.

The Two Months' War.

In 1859 diplomatic complications led to a rupture of relations with France, which was followed by warfare, for two months, until in July the two Emperors, Napoleon III. and Francis Joseph, consummated the peace of Villafranca, Austria giving up Lombardy, Italy to be formed into a confederation under the presidency of the Pope, and Modena and Tuscany to be restored to their princes. The first constitution of Austria was promulgated in 1860, followed by a patent in 1861, which formed the basis of a charter that went into effect in 1867, with certain modifications rendered necessary by the recognition of Hungary's independence. In 1864 Austria joined Prussia in hostilities

upon the Danish duchies of Schleswig, Holstein and Lauenburg, and the war terminated in their acquisition.

But Austria speedily suffered terrible retribution for the part she had taken in the affair, the difficulty in disposition of the provinces bringing on war with her former ally. The Italians acted in concert with Prussia in hostilities upon Austria, and what is called the Seven Days' War ended in the Prussian victory at Königgratz, which led to peace negotiations at Prague, where a treaty was signed August 23d.

By this treaty Austria was shorn of Venetia and the fortresses of the quadrilateral, the dissolution of the German Confederation was recognized, all claim to Holstein and Schleswig was given up. The necessity of self-government for Hungary was recognized, and on June 8, 1867, Francis Joseph was crowned King of Hungary, in addition to his title as Emperor of Austria. A treaty of alliance with Germany and Italy was signed Mch. 13, 1887. A defensive treaty with Germany against Russian or other aggressions was made Oct. 7, 1879, but not published until Feb. 3, 1888. Archduke Rudolph, heir to the throne, committed suicide Jan. 30, 1889. In Dec., 1893, a commercial treaty was formed with Spain. The jubilee of Emperor Francis Joseph was celebrated in May, 1898.

THE RUSSIAN EMPIRE.

HISTORY records the fact that the Scythians and Sarmatians of the country bordering on the Don and Dnieper, were known to the Greeks and Romans of old, as they are mentioned hy Herodotus, Strabo and Tacitus. In the earlier centuries of the Christian era successive invasions of Goths, Huns, and other warlike peoples swept over the land, and either drove out or absorbed the native inhabitants. At this point we find the first mention of the Slavs, who drove the scattered Finnish tribes to the far north and became the founders of the Russian people and government. There stands in Novgorod a splendid monument which was erected in 1862 on the millennial anniversary of the foundation of the Russian Empire by Ruric the Norman.

But for many centuries the country was divided into practically independent provinces, some of which retained their autonomy up to a very recent period. The empire was divided and again united; it was broken into four parts; became a confederacy, and again, under Ivan III. (1462–1505), became a nation.

Christianity was introduced about the year 950, and two centuries later the greater part of the empire was overrun by the Mongols. From 1380 to 1470 tribute was paid to the Tartars, but Ivan the Great broke their power and his son and successor, Ivan the Terrible, contributed much to the greatness of Russia.

Under Peter the Great, the fourth monarch of the Romanoff dynasty, Russia emerged from barbarism, the boyars (noblemen) lost their influence, and the country assumed



CATHARINE THE GREAT AT THE HEAD OF HER ARMY.

the position which it has ever since retained as a leading member of the European family of nations. Since the time of Peter its national policy has been directed to the acquirement of additional European and Asiatic territory, and every reign has seen vast possessions added to this already enormous power.

Russia become involved in the general European wars of the first fifteen years of this century, and destroyed its most renowned city, Moscow, that it might not afford shelter to the hated invader, Napoleon. All efforts of the various nations which have at one time or another been absorbed by Russia to regain their independence have been barren of results; she never gives anything back.

Russia's Onward March.

Although her schemes of aggrandizement on the Black Sea were temporarily checked by the war of 1854–55, in which England, France and Sardinia supported the Ottoman Empire, Russia has since made greater strides east and south, and has almost attained her chief aim, the full and unrestricted control of the Black Sea. She presses England upon the line of the Himalayas, and China finds its great wall an insufficient defence against the disciplined legions of this great power.

Properly speaking, Russia is an Asiatic power with great possessions in Europe rather than a European power with subject provinces in Asia, and its march has been and continues to be in a directly opposite line to the ordinary movement of population and empire, which is westward.

There was much domestic disturbance in Russia during the years 1891 and 1892, in the former of which the country was distressed by poor harvests and famine in some localities, while in the latter year cholera carried off a quarter of a million persons. On November 1, 1894, occurred the death of Czar Alexander III. at Livadia, aged 49. Notwithstanding this recent death in the royal family, on the 26th of the same month, Czar Nicholas II. wedded the Princess Alix of Hesse-Darmstadt.

Her Power Felt Everywhere.

For a long time the influence of Russia has been paramount in the politics of eastern Europe and some parts of Asia. No sooner had Japan gained her brilliant victory over China in 1894 than the power of Russia began to manifest itself in the settlement of the terms demanded by the Japanese Government. In the early part of 1896 the same strong influence was brought to bear upon the Turkish question, which then was agitating the world on account of the Armenian Massacres, putting an effectual check upon English diplomacy.

The public income of Russia for 1895 was estimated at 1,214,378,030 roubles, having almost doubled since 1883. The internal taxes are collected in paper, but much of the customs dues are paid in gold. The value of the paper rouble is about fifty cents in our money, while the gold rouble is valued at about seventy-seven cents. But as only about one-tenth of the revenue is from customs, it is safe to put the yearly income of the government at a little over $600,000,000.

The exports of Russia to foreign countries consist principally of corn, flour, butter, eggs, flax, timber, linseed, raw wool and illuminating oils. The chief industrial centres are Moscow and the surrounding governments, St. Petersburg and Poland. The woolen trade is taking firm root in the South, chiefly through English capital and enterprise. The domestic industries carried on along with

agriculture are of great importance and a source of livelihood to vast numbers of the peasantry. The empire is very rich in all kinds of minerals, and its mining industry has of late years begun to advance with rapid strides and is full of promise.

NORWAY AND SWEDEN

NORWAY'S authentic history begins with A. D. 863–933, when Harold Harfager, or Fair-Haired, subdued the petty kings and united the tribes as a nation. Olaf I., who came to the throne in 995, destroyed the pagen temples, and laid the foundation of Trondhjem. In 1028 Canute the Great, of Denmark and England, drove Olaf out and became King. Then commenced a series of wars with Britain, followed by an invasion of Ireland. A warlike nation, they became noted for their prowess by water, and were a terror to the nations about them.

In 1262 the national prosperity of Norway began to decline after the defeat of Haco V. at the mouth of the Clyde, and his subsequent death in the Orkneys. Wars with Denmark exhausted the country's resources, national industries were checked, and the plague broke out in 1348 and ravaged the kingdom for more than two years, destroying two-thirds of the population. Centuries elapsed before this condition of decay was thrown off. The country not only lost its nationalty, but also its proper language, which finally became a corrupt mixture of those of its neighbors.

In 1380 the crown descended to the son of Olaf III., King of Denmark, and from that period down to 1814 these two countries were united. Margaret succeeded her son, Olaf III., reduced Sweden, and joined the three kingdoms under one monarch, under what is historically known as the "Union of Calmar." Gustavus Vasa severed this union with Sweden in 1523, and for two centuries Norway was scarcely more than a province of Denmark. About the beginning of the present century a better day dawned on Norway.

Union of the Two Countries.

After a series of dissensions and diplomatic complications, Russia, which had been engaged in warfare with Napoleon, indemnified Sweden for the loss of Finland—which on a former occasion Napoleon had signed away to Russia, without warrant—by the presentation of Norway, to which Sweden had no title. In 1814 the Danes acknowledged Norway as a dominion of Charles XIII. of Sweden, but a Danish prince, Christian, attempted to set up an independent sovereignity, but was compelled to abdicate, and on August 14th of the same year, Norway and Sweden were formally united, the ratification by the Storthing settling the matter on the 20th of October.

From this time the government became more and more liberal, titles of nobility were abolished, and the people styled citizens. In

1855 there was a good deal of anxiety felt over the encroachments of the Russian Government, and Norway, Sweden, England and France entered into an alliance in which "the two Scandinavian powers promised never to cede or sell territory to Russia, or to any other power, without the consent of England and France," and by this they received a guarantee of future territorial integrity under protection of the last named powers.

The modern history of Sweden follows somewhat in the pathway of its neighboring kingdom, Norway. After the establishment of the "Union of Calmar" (1397) by Margaret of Denmark, the three countries of Norway, Sweden and Denmark were kept together with great difficulty for 100 years. In 1520, Christian II. of Denmark became King, and so exasperated the people that they rose in revolt, with Gustavus Vasa at their head and their resistance to the government of the Danish King was so successful that, in 1523, Gustavus was made King of Sweden.

The country entered on an era of prosperity, and was governed in a manner more pleasing to the people, though the successors of Vasa attempted some radical changes which did not meet with general favor. The reigns of the sovereigns from 1600 were marked with almost constant warfare against adjoining kingdoms.

In 1741 Sweden was defeated in a war with Russia, and in 1743 East Finland was yielded to the conqueror. Following this, came a war with Prussia which was disastrous in the extreme. Again in 1787 Sweden was involved in a war with Russia and Denmark. In 1809 a new constitution was decreed. During the Crimean War neither Norway nor Sweden took any part therein. Of late years Sweden has prospered and made great improvement in manufactures, arts and sciences.

DENMARK

DENMARK has always exerted an influence in the affairs of Europe out of proportion to her size and military strength. Her authentic history dates from 1385, the year of the accession of Margaret, the "Semiramis of the North," and wearer of the triple Scandinavian crowns. After her glorious reign, Sweden, after a lengthened contest, succeeded in asserting her independence.

In 1658 Denmark was invaded and despoiled of some of her most important territories by the "Lion of the North," Gustavus Adolphus. In 1807 a British fleet under Lord Nelson bombarded Copenhagen and destroyed the Danish navy, and in 1815 Norway was transferred to Sweden, Denmark receiving in exchange the insignificant duchy of Lauenburg, with a money indemnity; a work of spoliation consummated in 1864-7 by the forcible acquisition of the Schleswig-Holstein duchies by Prussia, after a short but sanguinary struggle, in which the latter power, with the aid of Austria, overcame the brave Danes by sheer force of numbers.

In 1863 died Frederick VII., the last monarch of the House of Oldenburg, who was succeeded by the present King, Christian

IV., of Schleswig-Holstein-Sonderburg-Glücksburg.

The peaceful relations already existing between Denmark and England were confirmed by the marriage of Princess Alexandra of Denmark to the Prince of Wales, at Windsor, March 10, 1863.

When the war broke out between Austria and Prussia, in 1866, and resulted in the humiliation of Austria, the hope of Denmark that a part of her original territory, which, as already stated, had been acquired by Prussia, was frustrated. Notwithstanding her dismemberment, Denmark has prospered to an astonishing degree, and her material fortunes have been constantly in the ascendant. Her only trouble within the last decade has arisen from the dissensions in the two houses of Assembly and in the spread of dangerous communistic opinions.

The Government of Denmark is a constitutional monarchy, the King being assisted by a cabinet of seven ministers. Elementary education is widely diffused and attendance at school is compulsory for children between the ages of seven and fourteen years, poor parents paying only a nominal sum toward the government schools, of which there are about three thousand. The established religion is Lutheran, to which the King must belong, but complete toleration is enjoyed in every part of the kingdom. The present King of Greece is a prince of the royal house of Denmark.

HOLLAND—THF NETHERLANDS

BY the revolution of 1830, Holland, or the Netherlands, was separated from Belgium. The earliest accounts of the Netherlands are from the Romans, by whom all the southern and central part (called Belgia) was kept in subjection till the decline of their empire in the fifth century. It was formerly under the government of counts, but being incorporated with the extensive possessions of the Duke of Burgundy, the Netherlands passed to Maximilian of Austria, father of Charles V., who united the seventeen provinces into one state; but the bigotry of his son Philip II. produced the separation of the Dutch provinces, and great dissension and distress in the others.

They remained under the Spanish crown until the middle of the seventeenth century, when arduous exertions were made by Condé and Turenne to add them to the dominions of Louis XIV. The quadruple alliance, concluded at the Hague in 1668, however, put a stop to their progress, but the wars from 1672 to 1679, and 1680 to 1697, were prosecuted chiefly for the Netherlands. At length, in 1702, Louis obtained them, but the French being defeated by the Duke of Marlborough at the battle of Ramilies, in 1706, the southern provinces were brought under the power of the allies, and assigned to Austria at the peace of Utrecht.

A peace ensued, until the war of 1741 was transferred to the Netherlands, and the French under Marshal Saxe recovered them.

Bergen-op-Zoom was captured by the French in September, 1747, and Maestricht in the following year, when the successes of the British navy, and the persevering aspect of the coalition, led to the peace of Aix-la-Chapelle in 1748, and the southern Netherlands thus became restored to Austria. By the treachery of Austria in 1756 they were once more nearly ceded to France, but the scheme was not carried into effect.

In the campaign of 1792 Austria again lost the Netherlands, and though recovered in 1793, they again passed over to France in 1794. The hope of recovering them was the cause of the coalition of 1799 and 1805, both baffled in their object. The disasters of the French army in Russia in 1812, at length opened the long-wished-for prospect. In 1813 Germany occupied all the exertions of the allies, but in 1814 the Netherlands were detached by a consequence of the revolution by which the Bourbons were restored; and the British Cabinet accomplished the union of the seventeen provinces, and their erection into an independent state, under the Prince of Orange, in 1815. The Prince, therefore, assumed the title of King of the Netherlands and Grand Duke of Luxembourg.



VIEW OF DORT.

The bill for the emancipation of the slaves in the Dutch West Indian possessions, passed in 1862, decreed a compensation for each slave and came into force in 1863. The expenses of this emancipation came to $5,065,366, and the number of slaves set free was about 42,000, of whom 35,000 were in Dutch Guiana.

The present King having no living male issue, the succession to the crown was vested in the Princess of Orange, Wilhelmina, the only child of King William's second marriage, born in 1880. Of late years the great question of internal politics has been the new constitution, which was duly promulgated November 30, 1887. This act increased the electorate of Holland by no less than 200,000 voters. A revision of the school laws in a sectarian sense was carried early in December, 1889. Meanwhile, in 1888, the Queen, Emma of Waldeck, had been appointed regent in the event of the King's demise, and a council of guardians named to assist her in the education of Princess Wilhelmina.

Many industries are carried on, and the country has a large percentage of skilled artisans. Amsterdam has had the largest diamond-cutting trade in the world, ten thousand persons depending on that branch of industry, although in recent years it has been on the decline.

The Dutch were once called the "Carriers of Europe."

Wilhelmina, Queen of the Netherlands, attained her majority and came to the throne on August 31st, 1898. The regency of her mother ceased at this time; it had continued from November 23, 1890. On Feberuary 7th, 1901, the Queen was married to Duke Henry of Mecklenburg-Schwerin.

BELGIUM

IN the time of the Romans, Belgium was included in Gaul, and was known as *Gallia Belgica*. The people were mostly Celts, but while under the rule of the Franks, in the 5th and 6th centuries, by irruptions from the North the principal element of the population became German.

The country was afterwards divided into a number of independent duchies, counties and free cities, the principal of which was the County of Flanders. The male line of the Counts of Flanders became extinct in 1385, and their possessions passed into the hands of the Dukes of Burgundy, who soon after obtained the whole of the Netherlands.

By the marriage of Mary of Burgundy with Maximilian in 1477, the Netherlands came into possession of Austria. Maximilian was succeeded by his son Philip, who married Johanna, daughter of Ferdinand and Isabella of Spain, in 1496.

Holland, the northern portion of the Netherlands, established its independence, while the southern portion, Belgium, continued under the rule of Spain, Philip ceded Belgium to his daughter, Isabella, and her husband, the Archduke Albert, in 1598, under whom it formed a distinct and independent kingdom. Albert died in 1621 without issue, and the country again fell into the hands of Spain.

Between 1659 and 1697 Belgium lost considerable territory in the wars between Spain and France and Holland. By the treaty of Utrecht in 1713, Belgium was assigned to Austria. During the war of the Austrian succession almost the whole country fell into the hands of the French, but by the peace of Aix-la-Chapelle it was restored to Austria, 1748. In 1790 the provinces of Belgium revolted against Austrian rule, and formed themselves into an independent state under the name of United Belgium. They were, however, subdued by the Austrians in the end of the same year.

Austria's Power Overthrown.

In the war with revolutionary France the battle of Fleurus (1794) put an end to the Austrian rule in Belgium. In 1815 it was united with Holland under Prince William Frederick of Nassau. Belgium revolted in 1830, declared itself an independent state, and chose Leopold, Prince of Saxe-Coburg, as its king, in 1831. The five great powers afterward determined the limits of the territory, making Holland and Belgium separate kingdoms. Leopold died in 1865, and was succeeded by his son, Leopold II., the present monarch.

On the outbreak of the Franco-German war in 1870 the Belgians, fearing risks both from Prussia and from France, mobilized their army ; but in a special treaty arranged by England, both belligerents recognized anew the neutrality of Belgium, guaranteed in 1831 and 1839. In 1885 the Congo Free State, under the presidency of Leopold II., was acknowledged by the powers.

Although the country has, on the whole, steadily grown in prosperity, and constitutional principles have been generally strengthened, yet 1886-87 witnessed industrial riots and Socialist disturbances of a serious aspect, attended at Liege, Mons. Charleroi and other places with great violence. The King, at the opening of the Chambers in November, promised that measures of reform should be introduced, and this had the effect of quelling the disturbances. In 1880 the jubilee of the state was celebrated with enthusaism.

King Leopold has distinguished himself by being the patron of Henry M. Stanley in his African explorations, having rendered material aid to the explorer.

The government is a constitutional hereditary monarchy, the members of the House of Representatives being elected by citizens who pay not less than twenty florins annually in direct taxes. The King can convoke, adjourn or dissolve the Senate and House of Representatives at pleasure. Under the mild and successful government of Leopold, the country has prospered, and the people seem attached to their King and constitution, and are peaceful and contented

SWITZERLAND

SWITZERLAND, the ancient *Helvetia*, became, under the Roman empire, a semi-civilized country, and, after the fall of that power, passed in succession under Burgundian, Frankish and Germanic sway. In 1307 a movement of the three northern cantons of Schwyz, Uri and Unterwalden inaugurated the ultimate overthrow of Austrian rule in the result of the battle of Morgarten in 1315.

During the two following centuries the other cantons fell one by one into the arms of the Helvetic Confederation, which latter, however, did not obtain its solidarity as a European power until the peace of 1814.

In 1815 the perpetual neutrality of Switzerland and the inviolability of her territory were guaranteed by Austria, Great Britain, Portugal, Prussia and Russia, and the Federal Pact which had been drawn up at Zurich, and which included three new cantons, was accepted by the Congress of Vienna. The Pact remained in force till 1848, when a new constitution, prepared without foreign interference, was accepted by general consent. This, in turn, was, on May 29, 1874, superseded by the constitution which is now in force.

Following the new constitution of 1848 came the revolt of Neufchâtel against Prussia, to which country it had belonged, and its reception into the Swiss Confederacy

as a canton on an equal footing with the rest. During the Franco-German war of 1870–71 the landwehr were called out as a measure for the maintenance of Swiss neutrality.

The sublime scenery of the Alps draws tourists to Switzerland from all parts of the world and renders this remarkable country a constant and general object of interest.

ITALY

ITALY, since the downfall of Rome, has been divided into different states, and has lost that power which it formerly enjoyed. Its historical remains, its schools of art, its delicious climate, give it an undying interest. It has been called the garden of Europe; and the panegyric which Pliny bestows upon it does not seem in any degree exaggerated.

The ancient inhabitants called themselves Aborigines, offspring of the soil, and the country was soon after peopled by colonies from Greece. Italy has been the mother of arts as well as of arms, and the immortal monuments which remain of the eloquence and poetical genius of its inhabitants are universally known. The early part of the history of this country is, however, involved in the greatest obscurity. The first light thrown on this land of darkness was by the settlement of Greek colonies in the south, where, eventually, a large tract of country was called Magna Græcia. The annals of Rome are said to go back 750 years B. C.

Italy continued subject to one power for more than 800 years; until the fifth century, when the Goths crossed the barriers of the Alps. Toward the year 560 A. D. the Lombards entered the north of Italy, took Milan and Pavia, and founded a kingdom which continued during two centuries, until overthrown by Charlemagne.

Prolonged Military Struggles.

After his death Italy belonged to his successors on the imperial throne, but their tenure was precarious, the great barons laboring to assert their independence and the popes to extend their temporal dominions. The subsequent history is little more than a succession of military struggles, of little interest, until 960, when Otho I. repaired, in person, to the north of Italy, granted municipal rights to the cities, and improved the interior government in general.

The whole was united to the German Empire; but from this compact fresh feuds and commotions followed; the Italian nobility were jealous of their privileges; conspiracies were formed, detected and suppressed, and no constant allegiance was exhibited to the German Government or the magistracy put into authority by it.

A series of wars continued for several ages. In the fourteenth century Italy was divided into the kingdom of Naples, the estates of the Church, Tuscany, Parma and Lombardy, the Genoese and the Venetian territories and other petty states. For two centuries the Venetians and the Genoese

were the most considerable commercial people in Europe, and Venice, in particular, possessed large foreign colonies, and in 1194 took Constantinople and held in sovereignty portions of what now constitutes Turkey in Europe and Greece.

The foundation of the temporal power of the popes was laid about 1080, by Matilda, Countess of Tuscany, who bequeathed a large portion of her dominions to Pope Gregory VII. After that time the popes successively made great acquisitions of territory; but in 1798 Rome was taken by Berthier, and Bonaparte annexed the papal dominions to France. They were, however, restored in 1814.

In March, 1860, Savoy and Nice were ceded to France, to which they are still attached. Garibaldi and his volunteers conquered the Two Sicilies, Francis II. of Naples fled in terror, and the end of the great popular uprising was that in March, 1861, Victor Emmanual of Sardinia was proclaimed King of Italy. The Austrians held Venice until 1866, when Italy and Prussia united their forces against her. Rome remained in the hands of the French until the outbreak of the Franco-German war, in spite of the abortive revolutions instigated by Mazzini and Garibaldi.



NAPLES, SHOWING MOUNT VESUVIUS IN THE DISTANCE.

Finally, on September 20, 1870, the national forces entered Rome, which became at

last the capital of United Italy. Victor Emmanuel was succeeded in 1877 by his son Humbert. The Pope still resides in Rome, but has no jurisdiction except within what is known to Italy as the "Leonine City." Parliamentary government has been accorded in the fullest degree.

The defeat of the Italian army in Abyssinia, March 2, 1896, caused great excitement at Rome.

King Humbert I. was assassinated July 29, 1900, and his son, Victor Emanuel, prince of Naples, born November 11th, 1869, came to the throne.

SPAIN

SPAIN, after being partially colonized by the Phœnicians and Carthaginians, became a Roman province under Augustus, and some 400 years afterward was successively overrun by the Vandals, Goths and other northern races. In the eighth century the Moors successfully invaded the country, and remained virtual masters of the entire Spanish portion of it till the reign of Ferdinand and Isabella, when, in 1492, they were finally driven back into Africa.

Under Charles V., and his son Philip II., Spain became the greatest power in the then world. But with the latter prince began that decay which speedily reduced it to a mere shadow of its past glory and importance. After the death of Charles II., in 1700, began the so-called *War of the Spanish Succession*, in which the rival claims of France and Austria to the throne terminated in favor of Philip V., grandson of the French King Louis XIV.

Between 1759 and 1763 an unsuccessful war was waged against England, and in 1778 Spain again took up arms against that country, and at the peace of 1783 received the island of Minorca and the American Floridas.

The later chief events in Spanish historical annals have been: The struggle against Napoleon during the so-called *Peninsular War;* the restoration by French arms, in 1823, of the Bourbon dynasty in the person of Ferdinand VII., whose tyranny had led to a revolution in 1820; the *Carlist War*, 1833-40, ending in the triumph of the Christinos; the exile of Queen Christina in 1854; a war with Morocco in 1858-9; the annexation of St. Domingo in 1861; a war with Peru and Chili in 1864-5; the downfall of the Bourbon monarchy in 1868; the insurrection in Cuba in 1868-75; the election of Amadeus of Savoy as King of Spain in 1870; his abdication in 1873; the adoption of a republican form of government under Castelar and Serrano, 1873-4; and the restoration of the monarchy in the person of Alfonso XII., son of Isabella, January, 1875. Spain, from 1873 to 1875, was the theatre of a civil war waged against the government by the adherents of Don Carlos, who held nearly all the northeast of the country.

In 1898 war broke out between the United States and Spain. The battleship Maine was blown up in the harbor of Havana, and this act had much to do with the outbreak of hostilities. The sympathies of the United States were with Cuba in her struggle for independence, and the ulitmate result of the war was the overthrow of Spanish rule and inhuman oppression in that island.

Admiral Dewey destroyed the Spanish fleet in the harbor of Manila, our Atlantic squadron destroyed the Spanish fleet at Santiago, and our land forces captured the town. A treaty of peace was signed in November, 1898.

PORTUGAL

UNDER its ancient name of Lusitania, Portugal was constituted a Roman province under Augustus, and so remained till the fifth century, when it became subject to the Visigoths. In the eighth the Moors took possession of the country and held it for four centuries, at the end of which period they were driven out by Prince Alonzo Enrique, of Castile, who thereupon was elected King. Under the dynasty he founded Portugal made rapid progress, and under John I., and in the reigns of John II. and Emanuel, 1481–1521, became eminent as a maritime and colonizing power, establishing settlements in the East and adding Brazil to her dominions.

Under Sebastian III. began that fruitless crusade against the Moors which cost that monarch both his life and crown. Later, Portugal became a dependency of Spain, but in 1640 she threw off the yoke and placed the Braganza dynasty on the vacant throne. In 1807, after the deposition of the royal family by decree of Napoleon, Dom Pedro, the King, withdrew to Brazil, of which country he became first Emperor.

The Government is a limited monarchy, and the Legislature, known as the *Cortes*, consists of two houses—one of Peers, the other of Deputies. The Roman Catholic is the state religion, but entire toleration with respect to others prevails.

A Steady Decline.

For many years the financial condition of Portugal has gone steadily from bad to worse. The rush of the European powers to appropriate African soil awakened, for a time, her old spirit and ambition, but the awakening came too late. The march of events and the energy of her rivals have wrested from her many square miles that she claimed as her own, but had done next to nothing to colonize and develop. England in the end of 1889 compelled Portugal to abandon her claims to Nyassaland, and two years later a treaty was signed defining the

respective spheres of influence of the two countries in East and West Africa, especially in the basin of the Zambesi. Further delimitations were agreed upon in 1891.

In the meantime Charles I. had succeeded his father, October, 1889. The action of Britain occasioned an outburst of strong popular feeling in Portugal, which the republicans turned to their own advantage, and they were greatly helped by the successful revolutions of the republicans in Brazil and the expulsion of the Emperor, November 1889. But in the home country their advantage proved to be only temporary.

GREECE

GREECE shares with Rome the absorbing interest of ancient classic story. Glorious in arts and arms, renowned for her temples and mythology, her warriors, poets and statesmen, her controlling influence at one time in the affairs which make up the annals of ancient nations, she is at once the admiration of the scholar, the artist and the historian. Her classics have come down to us with all the charm of learning and romance and have long been the study of the most cultured classes of modern times.

The earliest settlers in ancient Greece were the Pelasgi, who were in course of time replaced by the Hellenes, a people which consisted of four tribes, namely, the Æolians, Dorians, Ionians and Achaians. Colonists from Phœnicia and Egypt followed the Hellenes, and joined with them in extending their united sway over the country. About 2000 B. C. the great cities of Athens, Sparta, Thebes, Argos and Corinth sprung into existence, and became in course of time the centres of political governments of a democratic form, and of a progressive advancement in civilization, education and artistic refinement. Their commerce embraced within its scope the ports of Gaul and the Mediterranean, at the same time that their naval and military power became extended in a corresponding ratio.

Philip of Macedon.

Civil discords, however, originated the Peloponnesian War, B. C. 434–404, by which their union of interests became broken up, and rendered Greece a prey to foreign invasion under Philip of Macedon, who, after the battle of Cheronæa, B. C. 338, became master of the country. Afterward, by the disruption of the Achaian League, Greece became a Roman province, 146 B. C. Then followed the decline and ultimate extinction of the glories of Greek art and civilization.

Invasions by the Goths, Vandals and Normans succeeded one another in turn till 1261, when the whole country—except Athens and Nauplia—became merged in the Greek Empire of Michael Palæologus. The Turks took possession in 1481, but their tenure of the country was contested for a period of two centuries by the Venetians,

until finally it was definitely secured to them by the treaty of Passarovitz.

In 1821 a revolution broke out against the Ottoman yoke, and the independence of Greece was secured by the interference of foreign powers, after the defeat of the Turks at Navarino, 1827. After a brief provisional government under Count Capo d'Istria, Greece was made into a monarchy by the protecting powers, and Otho, of Bavaria, placed on the throne in 1832. He reigned till 1863, when he was dethroned and the crown conferred upon George I., a prince of the reigning house of Denmark.

TURKEY

NO reputation less enviable belongs to any nation of the globe than that of Turkey. "The Unspeakable Turk" has long been an object of suspicion and hatred by reason of political intrigues, violation of sacred oaths, the rapacity that characterizes the savage, and the universal sentiment, amounting to a tyrannical law, which subjects everything to the reign of the Mohammedan religion. The most recent history of Asia is dark with the crimes and massacres that have made Armenia the theatre of wholesale slaughter, such as perhaps is unparalleled in all the annals of time.

The Ottoman Empire, properly speaking, comprehends all the countries in which Turkish supremacy is directly or indirectly recognized, and it includes some of the most beautiful as well as most ancient sections of the globe, in point of civilization. As a whole, the empire is an aggregation of governments, often widely separated, and only united by having been the subjects of a common conquest.

The Turks are first noticed in history about the year A. D. 800. They came originally from Asia and are of Tartar origin. They captured a portion of Armenia, which they called Turcomania, and in a short time pushed their dominion to the Hellespont, and finally obtained a foothold in Europe. The petty states into which their dominions were at first divided were united under Othman, one of their chiefs, in 1289. After him came his son, and then his grandson, Amurath, who established the Janizaries in 1362, a powerful and well-disciplined army, composed of youths selected from his Christian captives. He conquered the greater part of Thrace, and made Adrianople his capital.

His successor, Bajazet I., conquered the greater part of the Eastern or Greek Empire and besieged Constantinople; but being summoned to Asia to stop the encroachments of Tamerlane, he had to abandon the siege. Bajazet assumed the title of Sultan,

his predecessors being known by that of Emir. In 1453, Mahomet II. took Constantinople and made it the capital of the Turkish or Ottoman Empire. His grandson, Selim I., conquered Syria and Egypt, and Solyman the Magnificent, annexed the greater part of Hungary and extended the Turkish dominions in the East.

The Turks Defeated.

From the reign of Solyman the power of the Ottomans continued unabated till 1683, when John Sobieski, King of Poland, defeated the Turks and drove them out of Austria and Hungary. Thenceforward the power of Turkey continued steadily to decline. By the peace of Carlowitz, in 1699, Austria, Venice and Poland received back the territory previously wrested from them by Turkey.

During the eighteenth century Turkey was engaged in an almost uninterrupted series of wars with Russia, the result of which was seriously detrimental to the Turkish interests. Russia secured the Crimea and Azov, and the River Dniester was made the boundary between the two empires.

The Greeks rose in rebellion in 1821, and adopted an independent provisional constitution in 1822. The manly efforts made by the Greeks in face of overwhelming odds induced liberty-loving people in many European countries to furnish the patriots with men and money. Prominent among those who figured in the struggle for Grecian freedom was Lord Byron, who died at Missolonghi in 1824. Russia, France and England finally interfered in behalf of the Greeks, destroyed the Mohammedan fleet at Navarino, and compelled Turkey to acknowledge the independence of Greece, 1829.

In 1853 the Emperor Nicholas of Russia demanded that a Russian protectorate be established over the Greek Christians in the Turkish Empire—a demand that was resisted by the Sultan. Nicholas thereupon declared war and invaded the Danubian Principalities. England and France joined Turkey as allies in 1854, and in 1855 Sardinia also embraced the cause of the Sultan.

The Russians were defeated and had to evacuate the Danubian Principalities. The seat of war was then transferred to the Crimea, a peninsula in the south of Russia, on the Black Sea. Here the Russians were defeated by the allies at the battles of Alma, Inkerman and Balaklava. Sebastopol, the greatest Russian stronghold on the Black Sea, was besieged, and after a protracted resistance capitulated. Peace was finally concluded at Paris in 1856.

War with Russia.

The European powers having been unable to satisfactorily settle the differences between Turkey and her other rebellious provinces, Russia interfered in behalf of the latter, and declared war against Turkey in 1877. A desperate struggle ensued, the most celebrated battle fought being that of Plevna, in which the Turks suffered a severe defeat. The result of the war was that the Danubian Principalities secured their independence, and Russia received Bessarabia, Batoum, Kars and Ardahan in Asia.

Turkey in Europe at present covers about 62,028 square miles, and has a population of 4,786,545. Turkey in Asia occupies 710,320 square miles, and has a population of over 21,608,000.

In Egypt (the principal Turkish possession in Africa) the hold of the Sultan appears to be very weak. The present condition of Turkey seems to warrant the title, "the sick man of Europe," for some time applied to it.

Turkey has always been true to herself.

The history of the Mohammedan power is one of rapine, outrage and murder, and the massacres in Armenia were only what might have been expected. None the less they were enough to awaken the horror and indignation of all civilized peoples.

EGYPT

THE epoch of Menes is the first chronicle in the history of ancient Egypt, and has been placed at 5004 B. C. This fact points to a very ancient origin. Allusions are made to Egypt in the Book of Genesis and many other parts of the Bible. The history of the country is largely written upon tablets of stone, which in recent times have been deciphered, thus rendering Egypt a country of peculiar interest.

Unfortunately the decline which has affected all the old nations of the East has cast down the ancient glory and left everywhere the footprints of death. Still, in her ruins Egypt is a country of marvelous interest. Long subject to outside powers, she still maintains her traditional character and customs.

A royal dynasty ruled for some centuries before Cambyses, 524 B. C., and by that line of monarchs were constructed those grand pyramids, temples and obelisks, whose remains make of Egypt the oldest of classic lands. Cambyses brought Egypt under Persian sway till the time of the invasion of Alexander the Great, who built Alexandria.

After him came the line of Ptolemies, ending in the person of Cleopatra, under whom it became a Roman province. After a possession of 760 years the Romans gave place to the Saracens, who ruled Egypt till 1250, when the Mameluke dynasty was established.

At the beginning of the sixteenth century it fell into the hands of the Turks, under whom it became a satrapy, and the object of incessant contention among the Mameluke Beys. The French under Napoleon occupied the country, 1798-1802. In 1811, Mehemet Ali, after a massacre of the Mamelukes, made himself master of Egypt, and the succession was confirmed to him and his descendants by the treaty of London, 1841.

The Title of "King."

In 1866 enlarged powers were granted the Egyptian rulers by conferring on them the title of Khedive (king). The former Khedive Ismail Pasha, was deposed by the Sultan, June, 1879, and was succeeded by his son, Mohammed Tewfik.

The reigning Khedive is Abbas, born July 14, 1874, son of Mohammed Tewfik, who succeeded to the throne on the death of his father, January 7, 1892. In the summer of 1882, in consequence of a military rebellion, England intervened, subdued the uprising, and restored the authority of the Khedive. Egypt embraces 10,698 square miles and has a population of 6,817,265. The prevailing

religion is Mohammedan, exclusive of 600,000 Copts, who have the honor of being Christian descendants of the ancient Egyptians.

The country changes but slowly, is fixed aud stereotyped, like all others of the Orient, and gives little sign of progress.

PALESTINE

PALESTINE derives its name from the Hebrew *Pelescheth* ("Land of the Philistines"), and in remote times was known as Canaan. Under the reigns of David and his son Solomon, it constituted a flourishing kingdom. The subsequent history of Palestine is identical with that of Judea and of the Jewish people, until its subjection by Rome.

The country remained in the power of the Romans till the conversion of the empire to Christianity, when it became an object of religious veneration. In the sixth century it fell under the sway of the Mohammedans, which gave occasion to the Crusades. Jerusalem was taken by the European forces, and was under Godfrey of Bouillon erected into a Latin kingdom, which endured for above eighty years, during which the Holy Land streamed with Christian and Saracen blood. In 1187 Judea was conquered by Saladin, on the decline of whose kingdom it passed through various hands, till, in 1517, it was finally added to the Turkish Empire.

To all Christians throughout the world Palestine is a Holy Land. It is associated with the lives of patriarchs, prophets and apostles, and also with that of Jesus of Nazareth. Early in the Christian era Jerusalem received the blow that shattered its sacred temple, and began the downfall of the most remarkable nation of the ancient world. The old landmarks are obliterated, the country has been desolated, no bright future seems to be before it, yet of all lands on the face of the earth it is the one whose soil is trod with reverent feet, and whose localities have an absorbing interest to the visitor.

Modern Changes.

As regards Jerusalem, a new town has sprung up outside the walls, and there are about 50,000 Jews in and about the holy city. Yet the character of the ancient nation has been changed and Palestine as it once was does not exist.

The present condition of the country shows the beginning of rapid changes in every direction. The thousands of visitors who every year pour into the country contribute in no small degree to alter the character, the habits and the ideas of the people. Roads are being everywhere constructed in a country where, but a few years ago, there were no roads. The traveler can now drive from Jaffa to Jerusalem, from Jerusalem to Jericho, and also from Jerusalem to Hebron. Societies formed for ex-

ploration have done much toward preserving the history of the country as revealed in its present ruins Those who wish to see Palestine as it has been for a thousand years and more, must go at once or they will never have the opportunity.

ARABIA

ARABIA consists of a peninsula, with a length of about 1500 miles, a breadth of 900 miles (Suez to Bassorah), and an area of more than 1,000,000 square miles. It sea-coast is over 1200 miles long, and a large proportion of the country is an arid, sandy desert. On the shores of the Red Sea and Persian Gulf there is, however, considerable good and fertile land.

The Arabs claim descent from Ishmael, and have always been a wild and independent people of nomadic instincts. Their history proper begins with the advent of the prophet Mohammed and the foundation of the Caliphate. There are properly from 12,000,000 to 15,000,000 inhabitants of the Peninsula, of whom all but a few Guebres (fire worshippers), some negroes and a few Jews, are Mohammedans.

Coffee, believed to be indigenous, is one of the chief articles of export, and balm, frankincense, gum arabic, cassia and other drugs and spices grow freely. Wheat, barley, beans, millet and lentils form the food of the natives, and almonds, dates, and tamarinds are largely exported. The rivers of Arabia are few and unimportant; the heat is intense, and little rain falls at any season.

CHINA

THE early history of China is lost in antiquity. In the 11th century the country was subjugated by Jenghis Khan, whose descendants were afterward supplanted by the *Ming* dynasty of native princes. In 1294 the first Christian missionaries reached Pekin. In the early part of the 17th century, the Ming dynasty was subverted by the Mantchoo Tartars, who substituted an emperor of their own race.

The first foreign powers to establish relations with China was Great Britain in the 17th century. In 1839, seizure by the government of opium belonging to British mer-

chants was the cause of hostilities, known as the "Opium War," 1840, and which was put a stop to by treaty in 1842, by which the Island of Hong-Kong was ceded to England, five ports opened free to foreign commerce, and a heavy indemnity paid the English merchants. This treaty was followed by one with the United States in 1844, and with France in 1845. In 1851, a rebellion on a large scale broke out, known as the Tae-ping Civil War, which, after many successes on the part of the rebels, was temporarily suppressed in 1853. Another war with England, in conjunction with France, occurred in 1856, in which Canton was bombarded, and Pekin menaced by the Europeans. Another treaty, June 26, 1858, terminated hostilities, and gave new and important advantages to foreigners, among which were the toleration of Christianity, the opening of new ports to commerce, and the reception at Pekin of foreign envoys.

In 1859, an attempt to ignore this treaty led to the occupation of Pekin by English and French troops; after which the treaty was ratified. From 1861 to 1868, the Tae-ping rebellion broke out anew, with slight intermissions. In 1867, Mr. Burlingame was appointed envoy-extraordinary from the United States to Pekin, and in 1868 effected a treaty with China, which conferred on Americans in China the same rights and privileges possessed by Chinese in the United States. The war between China and Japan in 1894 resulted disastrously to the former, the superiority of the Japanese arms being evident at every point of the contest. China sought by diplomacy to avert further catastrophe, and the strong hand of Russia was soon seen in the terms of peace.

In June, 1900, there was a violent outbreak in China against foreign residents, including representatives of the various governments and the outbreak was suppressed only by the armed intervention of the Allied Powers. Indemnities were demanded and guarantees that the foreigners in China should be protected.

JAPAN

THE empire is politically subdivided into provinces, departments and districts, formerly governed by upwards of 200 princes called *Daimios*, each of whom held absolute power over his own jurisdiction; in 1870–1, these princes were made subordinate to the *Mikado*, or supreme ruler of the Empire. This Mikado, or Emperor, is considered of semi-divine origin, and was until quite recently invisible to the people at large.

In 1542 the Portuguese established a settlement at Nagasaki, and the Dutch obtained a temporary footing in 1600, but intercourse with the outside world came to be entirely suspended until about the middle of the present century. Since 1867, several embassies have visited the United States and Europe. In February, 1889, a new consti-

tution was promulgated, establishing important reforms, such as a parliament, the right of suffrage to all men twenty-five years old and over, who pay a certain amount of tax, liberty of religion, of speech and the right to hold public meetings. Judges cannot be removed, except by special legislation.

Japan has shown a remarkable ability to adapt herself to Western civilization. With singular acuteness she has adopted ideas from other countries, and within the last few years has undergone rapid changes. These do not so much affect her form of government as her system of education, and, to some extent, her manners and customs. The Japanese have been called the "Yankees of the Orient."

When war broke out between her and China in 1894, she showed herself fully equipped for the conflict by possessing arms of the most recent type and by being thoroughly versed in the most approved methods of military tactics. Her swift and brilliant victory was anticipated from the first.

BRITISH INDIA

IN the widest sense of the term, British India comprises all that part of the great Indian peninsula which is directly or indirectly under British rule, as well as certain countries beyond that area which are under the control or protection of the Governor-General. The Government of the Indian Empire is entrusted to a Secretary of State for India, assisted by a Council of not less than ten members, vacancies in which are now filled up by the Secretary of State for India.

But the major part of the Council must be of persons who have served or resided ten years in India, and have not left India more than ten years previous to the date of their appointment; and no person not so qualified can be appointed unless nine of the continuing members be so qualified. The office is held for a term of ten years; but a member may be removed upon an address from both Honses of Parliament, and the Secretary of State for India may for special reasons reappoint a member of the Council for a further term of five years. No member can sit in Parliament. Therefore it will be seen that the intention is not to allow the representatives in the Council to have any controlling voice in the affairs of the country, yet they possess a certain influence.

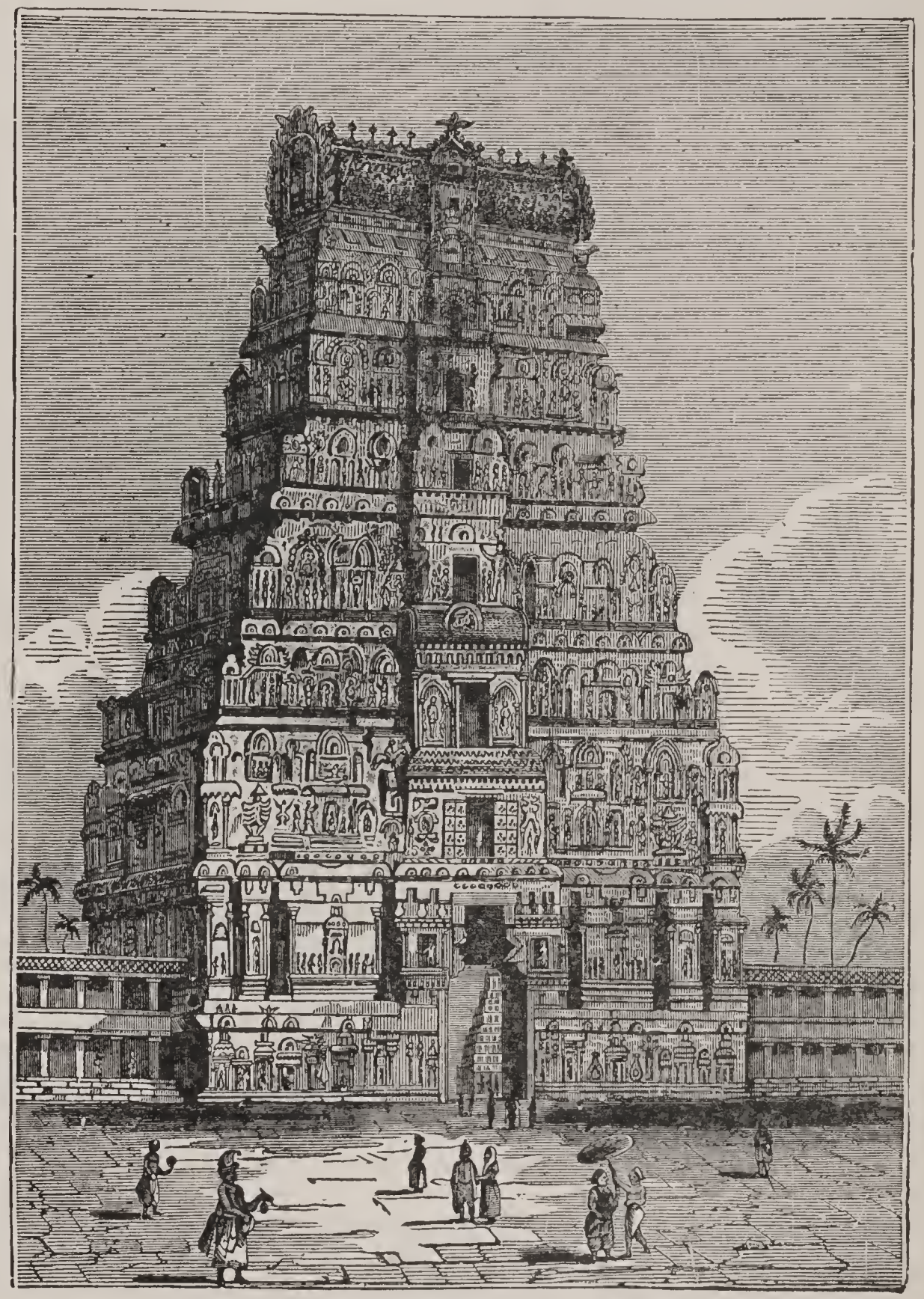
India is the ancient name of all that part of Southern Asia which extended from Persia to Serica (North China). The knowledge possessed of this portion of the world is extremely small, and dates from the expedition of Alexander the Great. Seleucus Nicator extended the conquests of the Greeks beyond the furthest point reached by

Alexander. Ptolemy learned more from subsequent travelers, and his grand division of the country into India Within and Beyond the Ganges has remained to the present day.

From the time of the expedition of Alexander the Great, in the 4th century, B. C., down to the 15th century of our era, the history of India, divided as it was into an infinity of independent states, is of comparatively little interest for the general reader. In 1525 the country was invaded by Baber, who established the Mogul line of princes, whose power culminated under his successor Aurungzebe.

British Arms.

After the latter's death, 1707, the Mogul dynasty began to decline; and after an unsuccessful attempt made by the French to establish their power in India, the foundations of a vast political power were laid between 1750 and 1765, by the greater resources and superior maritime strength of the English. Since that period the history of India presents but a succession of battles fought and territories conquered by British arms.



PAGODA OF CHILLENBAUM, INDIA.

In 1857 occurred the great Sepoy mutiny, which was extinguished after much bloodshed. In the year following, the foreign commerce of India, long a monopoly in the hands of the East India Company, was finally thrown open to the world, and their political jurisdiction vested in the British crown. The assassination of the Governor-General of India, the Earl of Mayo, in 1872, first attributed to political motives, seems to have been only an act of fanaticism. In 1878, over 500,000 deaths occurred at Madras alone by famine.

The costume is in numerous nationalities characterized universally by the ease, lightness and loseness common in the East and

suitable to the hot climate. But it varies in the many provinces, and, indeed, with every nationality. The turban (pagri) has every sort of dimension, from minute neatness to turgid massiveness.

The waistband (dhoti) extends often below the knee, in which case there is no trouser. Jackets in many styles are common. The woman's dress in many respects resembles that of the men. The petticoat is not universal. The headdress is often extended, so as to hang gracefully down the back. The shoe is not always worn; indeed, the humbler classes are generally barefooted. With them the blanket is often a plaid.

The black colors of Europe are seldom seen, but indigo blue is common. Otherwise white, set off by gay margins, and rich scarfs and shawls is the prevailing color. As a whole the national dress is picturesque, and a holiday crowd has the appearance of a flower garden.

Four-fifths of the population are affected largely by the caste system connected with the popular religion. A religious sanction in some degree attaches to infant marriage, or child marriage, with all classes; also, to the seclusion of women, and to the prohibition against remarriage of widows with the upper and middle classes.

In practice the women of the masses are not secluded, but, on the contrary, appear everywhere, and work out of doors; they remarry, too, if in widowhood. The burning of widows on the funeral pyres of their husbands has long been suppressed by the



ENGLISH TROOPS ON THE MARCH IN INDIA.

criminal law under British rule. Polyandry is found only among a few of the aboriginal tribes. Old customs, many of them barbarous and cruel, are disappearing before the advance of Christian civilization, but here, as elsewhere, the advance is very slow.

AFGHANISTAN and BELOOCHISTAN

AFGHANISTAN is subdivided into the three separate principalities of Cabul, Candahar and Herat. The Afghans belong to the Iranic race; they are of a vigorous spirit and proud temper. Afghanistan is continually being threatened by England and Russia, both of which nations desire the possession of Herat, which is the key of Central Asia.

The area is estimated at 225,00 square miles. Four-fifths of the country consists of rocks and mountains; the latter from the table-land in the north, varying from 15,000 to 16,000 feet in height and in the case of the Hindoo Coosh, to 20,493 feet.

Beloochistan is subdivided into six provinces. Nearly the whole country is mountainous, except in the northwest and along the coast, its general characteristics being a rugged and elevated surface, barrenness and deficiency of water. The famous Bolan mountain pass, which is the only means of communication with the interior of the country from the plains of Northwest India, is on the northeastern boundary. Kelate, the capital, is situate at 6000 feet above sea level. The products vary with the climate, which is cold in the elevated parts, and excessively hot in the lower valley.

The pursuits of the people are mostly pastoral. The inhabitants consist chiefly of Belooches and Brohooees, two tribes which are probably a race of mixed Tartar and Persian descent. Beloochistan was formerly subjected to Persia, and afterwards to Afghanistan, but its people conquered their independence in 1758. They are ruled by several chiefs, under the more or less nominal authority of the Khan of Kelat

Products of the Country.

Among the natural productions of Afghanistan is the plant yielding asafœtida. The castor-oil plant is everywhere common, and good tobacco is grown in the district of Kandahar. Aitchison says that the cultivated area around Herat produces magnificent crops of wheat, barley, cotton, grapes, melons and the mulberry tree; the production being only limited by the amount of labor procurable.

Surrounding the villages and in orchards the ash, elm, apricot, apple, plum, quince, peach and pomegranite are cultivated. In special localities are forests of pistachio, its leaves being used in dyeing.

The general appearance of the country during winter is barren and arid in the extreme, owing to the absence of trees and woody shrubs; but in spring a mass of vegetation springs up, giving a grand coloring to the landscape. The industrial products are silk, chiefly for domestic use, and carpets.

The manufacture of *postins*, or sheepskins, is one of the most important of the industrial occupations of the people, and of late years the trade in this article has greatly increased. Afghanistan is crossed by several trade-routes leading to India on the one side, and to Persia and Turkestan on the other; merchandise is carried by camels.

SIAM

LITTLE of a reliable character is known of the early history of Siam. The foundation of Ayuthia, its former capital, dates from 1350, and in the sixteenth century its territorial rule extended from the Cambodia River as far south as the Strait of Malacca. In 1782 the existing dynasty mounted the throne, and in 1855–6, treaties were effected with the United States, England and France, which have largely facilitated foreign trade, opened out the resources of the country, and generally been the means of introducing many of the arts and manners of the Western nations among the Siamese people. The population is estimated at 6,300,000.

The monarchy is absolute and hereditary, and there are two kings, of whom the first is the actual reigning sovereign, the second receiving one-third of the revenue, and exercising the administrative functions of chief minister. Buddhism is the dominant form of religion, and the pagodas of Siam are the finest of all Indian temples. Within the last few years the king has raised a small regular army officered by Europeans; and in time of war the entire adult population are liable to be called out any time for military service.

The men are of an olive color, with little beard; but the women are of a straw complexion. They have been said to excel in the fabrication of gold, in fireworks and in miniature-painting; but in mechanical ingenuity they are decidedly inferior to the natives of China and Cochin-China.

Characteristics of the People.

The chief production of Siam is rice. It is the national food and its export forms a great source of wealth to the country.

The Siamese are very social, vain and fond of bright dresses and jewelry. Their intercourse with each other is conducted with ceremonious attention to distinctions of rank. They shave the heads of their children, with the exception of a tuft on the crown, which is cut off with great ceremony at the age puberty.

Marriages are negotiated by elderly women who find out if the birthdays of the intended bride and bridegroom are suitable, for the Siamese are superstitious in this respect. The marriage ceremonies, during which the chewing of betel-nut plays an important part, last two or three days and

all friends are entertained liberally during this time. The houses are built of wood or bamboo. thatched with palm. Furniture there is none, unless a mosquito net, a mat or two and cooking utensils be reckoned furniture, and these are very crude.

PERSIA

PERSIA dates its rise as a nation from after the fall of the Assyrian and Babylonian Empires, and under Cyrus extended from the Indus almost to Greece and Libya. Conquered by Alexander the Great, it became during several centuries afterward a Greek satrapy; and about 200 B. C. a Parthian monarchy. In the third century A. D. the native rule was restored under the Sassanides dynasty.

Later, Persia became the prey of the Tartars, the Turks, the Afghans, until redeemed by the victories of Nadir Shah. After the death of the latter the country again became the scene of social anarchy and civil war, which continued till the establishment of the present dynasty. In 1871–2 the more Southern and Eastern provinces were desolated by a terrible drought and famine, which swept away thousands of the inhabitants. In 1873 the Shah visited Europe. Estimated population, 10,000,000.

Some of the immense valleys of Persia abound with the rarest and most beautiful vegetable productions; among them are wheat of the very best quality, barley and other cereals, cotton, sugar, rice and tobacco. The vine flourishes in many of the provinces, and the wines of Shiraz are celebrated. The mulberry-tree is largely cultivated, silk being one of the most important staples of the country. The chief manufacture is that of silk stuffs, of the richest kinds; other fabrications include textile goods, arms, carpets, shawls, etc. Persian commerce is very extensive, and chiefly carried on with Russia by way of the Caspian Sea, and with British India by way of the Persian Gulf.

A Despotism.

The government is a despotism under the *Shah*, or sovereign; and though a large amount of the taxes levied never reaches the royal treasury, yet the latter is reported to possess immense wealth in bullion and precious stones. Mohammedanism of the Shiah type is the prevailing form of religion. The Persian (or Persic) is the most celebrated of all the Oriental languages in respect of strength, copiousness and poetic harmony, and is written from right to left.

The houses in Persia, those of the wealthiest people, not excepted, appear contemptible, being generally built of earth or mud and are grouped, even in the towns, with

little attention to uniformity or order. The interiors, however, of the houses of the rich are sometimes perfect paradises of luxury and elegance. The miserable look of the towns is, moreover, greatly redeemed by the beauty of the gardens which surround them.

THE BARBARY STATES

BARBARY and Egypt formed nearly all of Africa known to the ancients. It was peopled chiefly by Moors, Numidians and Phœnician colonists; it attained great celebrity during the Carthaginian dominion; was afterwards subject to the Romans, and occupied for nearly a century by the Vandals. The Arabs took it finally from the Romans, about B. C. 697.

Barbary is an extensive region, comprising all the northern portion of Africa, from Egypt to the Atlantic Ocean, and from the Mediterranean to the Greater Atlas. It is divided by the Atlas range into two regions, that on the north comprising the four Barbary States, viz., Morocco, Algiers, Tunis and Tripoli; and the southern region, called Beled-ul-Jerid, or Country of Dates.

In this region stood the celebrated city of Carthage in ancient times. Its site was about ten miles northeast of the present city of Tunis. It was founded by Phœnicians, eight hundred and sixty-nine years before the Christian era. The Phœnicians were the first people who engaged in commerce, and founded colonies for the purpose of carrying on trade.

The city of Algiers was built by the Saracens, in the year 944. The Government, called the Regency of Algiers, was founded in 1518, by two Turks, named Horuc and Hagradin. They were brothers, and both bore the name of Barbarossa, or Red-Beard.

American Resistance.

The country now called Morocco was conquered by the Saracens about the same time with the other Barbary States. So also was Tripoli. All these states, except Morocco, afterward fell into the hands of the Turks. During a long period, the Barbary States were in the habit of fitting out vessels to cruise against the ships of other nations. Their prisoners were sold as slaves, and never returned to their own country, unless a high ransom was paid for them.

The Americans were the first who made any considerable resistance to these outrages. In the year 1803, Commodore Preble sailed to the Mediterranean Sea with a small American fleet. He intended to attack Tripoli; but one of his frigates, the Philadelphia, got aground in the harbor. The Turks took possession of the Philadelphia. But one night Lieutenant Decatur entered the har-

bor of Tripoli, and rowed toward the captured vessel, with only twenty men. He leaped on board, followed by his crew, and killed all the Turks, or drove them overboard: the Philadelphia was then set on fire.

After this exploit, Commodore Preble obtained some gunboats from the King of Naples, and with these and the American vessels, he made an attack on the fortifications of Tripoli. The Bashaw of Tripoli was forced to give up his prisoners. In the year 1815, Commodore Decatur—the same who had burnt the Philadelphia—was sent with a fleet against Algiers. He captured their largest vessels, and compelled the Algerines, and the Tripolitans also, to agree never more to make slaves of Americans.

In 1816, Algiers was battered by an English fleet under the command of Lord Exmouth. This was the severest chastisement that the Algerines had ever received at that period. But in 1830, the French sent a large naval and military force against Algiers, commanded by Marshal Beaumont.

The war continued for seventeen years, an Arab leader, by the name of Abd-el-Kader, making a powerful resistance to the French. At length Abd-el-Kader was defeated and taken prisoner; so the country was conquered, and Algiers, under the name of *Algeria*, is now a province of France.

ABYSSINIA

ABYSSINIA was a part of ancient Ethiopia; its inhabitants are of a dark olive complexion. In 1867, the British Government, having wrongs to avenge, sent to Abyssinia an army of 10,000 men; and the expedition resulted in the death of the Emperor Theodorus II., and the destruction of his capital, Magdala.

A few years ago Italy endeavored to plant a colony in Abyssinia. The new colony is nearly self-supporting, but in their endeavor to extend their influence, the Italians came to blows with the Abyssinians whom they had taken under their protection. Abyssinia, the only state of Central Africa with a pretence to civilization, is made up of the territory of a few hundred fierce clans whose chieftains render more or less obedience to the "Negus" or King. The people of that country are nominally Christians, but their rites are strangely mixed with Pagan usages as old as their hills. The main difficulty between Italy and Abyssinia seems to arise out of the determination of the former to put down slavery.

Early in March, 1896, a bloody battle was fought between the Abyssinian troops and the Italian army, in which the latter was utterly defeated with great loss of life, and a check was put upon the ambition of Italy to make for herself a position like other European nations on African soil. The defeat created great excitement in Rome and other parts of Italy, and led to the instant downfall of the Crispi Ministry.

Abyssinia consists of two districts, Tigre and Amhara and Shoa. The country is mountainous, but in the vales the soil is fertile. The rainy season continues from June to September, succeeded without interval by a cloudless sky and a vertical sun,

but cold nights follow those scorching days. Though situate between the tropics, the productions of Abyssinia rather resemble those of the temperate than of the torrid zone. The population is estimated at 3,000,000.

REPUBLICS IN SOUTH AFRICA

ONE of the earliest settlements in South Africa was that of the Dutch at the Cape of Good Hope. In 1806 Great Britain acquired their domain, following which the Dutch emigrated in large numbers, moving north and east. They acquired by force of arms from the Zulas the country known as Natal, where they settled. The number of the Boers, as they were called, who left the British colonies was about 10,000. They organized a government, and in 1854 the British guaranteed them complete independence.

The Boers also established a republic known as the Transvaal, the independence of which was acknowledged in 1852. Here they have remained until the present time. They have had the name of being very exclusive and refusing rights to foreigners who wished to enter their country. In 1877 the republic was on the eve of dissolution, owing to an exhausted public treasury. The British government consented to assume care of it, but a rupture came, resulting in war and the conventions of 1880 and 1884 and conceding certain rights to the British.

Early in 1896 a British company, with possessions bordering on the Transvaal, attempted to conquer the Boers. In this attempt they were led by Dr. Jameson, but his force was signally defeated. This disaster caused excitement throughout England, especially as Germany expressed its sympathy with the Boers.

In 1898 war broke out between the British and the Boers, which, as it progressed, was favorable to the former.

The state has immense latent wealth in its minerals, for, in addition to the numerous gold-fields the deposits of silver, copper and lead, iron, coal, cobalt, and other metals and minerals, are sufficient to show that nature has favored the Transvaal beyond all African States. The country is rich in corn and pasture land. The climate is, as a rule, healthy, and in some parts exceptionally bracing. The number of English-speaking residences is fast increasing on account of emigration.

Republic of Liberia.

Liberia is a small Republican State of West Africa and occupies a part of the coast of North Guinea. Length, 600 miles; breadth interiorward, 50 miles. Monrovia is its capital, at the mouth of St. Paul's River. The principal exports are coffee, sugar, palm-oil, camphor, indigo, ivory and gold dust. The population consists of 20,000 "Americo-Liberians" (immigrants from America and their descendants) and 600,000 aborigines. The first settlement was formed by free negro colonists from the United States, at Cape Mesurado, in 1820. The colony became an independent republic

in 1847. The constitution and government are based upon the model of those of the United States.

The Congo Free State has sprung out of the discoveries of Stanley and the explorations of the International Association, founded at Brussels for the opening up to civilization of the Congo and its tributaries. Its autonomy was recognized during 1884 and 1885 by the leading powers of Europe, and by the United States, conditioned upon its maintaining the principles of free trade. There are twelve territorial divisions, the capital being Boma.

The central government is at Brussels, and consists of the King of the Belgians as sovereign, and three departmental chiefs. On the Congo there is an Administrator-General and several European administrators of stations and districts. The rest of West Africa is variously "protected" by England, France, Germany and Portugal.

CAPE COLONY



CAPE COLONY is an extensive territory belonging to Great Britain, comprising the greater portion of the South African continent. It has an area of 183,286 square miles, with a coastline of 1,150 miles. The entire country consists of three elevated plateaux intersected by three great mountain-chains, between two of which is what is called the Great Karroo, a desert plain nearly 500 miles long by 100 broad. The principal rivers are the Orange, Great Fish River, Elephant, and their affluents. Saldanha Bay is by far the best harbor on the coast. Minerals are known variously to exist, but have been hitherto little mined. Some gold has been found, together with diamonds and and other precious stones. The products are fruits, tobacco, wool, etc. Sheep-farming is the staple industry of the country. The chief towns are Cape Town (the capital), Grahamstown, Zwellendam.

The aborigines consist of Hottentots and Caffres; the colonists are chiefly English, Dutch and French. Cape Colony is governed by an English viceroy, and is an important British military and naval station, being considered the key to the Indian Ocean. In 1650, the cape was colonized by the Dutch, from whom it was taken by the English in 1795, and finally ceded to them in 1815. Population, 566,158.

Ostrich-Farming.

Ostrich feathers have long been an article of export from the Cape. For many years they were obtained at the expense of the death of the birds, but in 1864, ostrich-farming was commenced at the Cape and is now one of the leading industries. The feathers of the wild bird are more beautiful than those of the tame bird, and are recognized at once by those engaged in the feather trade. A few elephants and buffaloes are still preserved.

MADAGASCAR

MADAGASCAR is the largest of the African islands, situated to the east of the continent, from which it is separated by the Mozambique Channel, and surrounded by the waters of the Indian Ocean. It contains a population of about 4,000,000. It is 1010 miles in length, and 370 at its greatest breadth, containing an area estimated at 228,540 square miles.

The island was known to the early Arabs as Jezira-el-Komr, and became known under its present name through Marco Polo. Its actual discovery is due to the Portuguese, 1506. By a treaty signed at Tamatave, December 12, 1885, Madagascar was declared a French protectorate, and a port on Diego Suarez Bay was ceded to France, now converted into a naval station. The British acknowledged the French protectorate of Madgascar in 1890.

The soil is fertile, with rich pasturage, and magnificent forests abounding in valuable trees and medicinal plants; the other products are rice, sugar, silk, cotton, cocoanuts, bananas, sweet potatoes, indigo, pepper, India rubber, etc. Iron ore is found in several places, and coal is also said to exist; gold, silver, copper and lead are also found in small quantities. The principal manufactures are jewelry, chains, necklaces, straw hats and dresses, termed lambas.

AUSTRALIA AND NEW ZEALAND.

AUSTRALIA is an immense island-continent, containing 3,000,000 square miles and has about as much territory as the United States. Its nearest distance to England is about 11,000 miles. The mountains of any great height are all on the east side, and there is but one great river, the Murray. Gold is distributed more or less through all the Australian Colonies, but chiefly in Victoria, Queensland and New South Wales. Diamonds and other precious stones have also been found in different parts of the continent. The country is rich in Coal fields, mineral Oils and Copper mines. Silver, Iron and other metals form mines of inexhaustible wealth. Mining is a great and growing industry, employing many thousands of laborers. The highlands are rich in wood; 40 miles east of Melbourne are many trees over 400 feet high. The Vegetation of Australia is unique, being rich in species and in many parts very luxuriant. The climate is somewhat uncertain, and the country has large

barren tracts that are unproductive, but in large upland tracts agriculture, including the raising of sheep, is a profitable industry. Since the discovery of gold in 1851 the population has rapidly increased. The largest cities are Melbourne, capital of Victoria; Sydney, of New South Wales; Adelaide, of South Australia; Ballarat, of Victoria; and Brisbane, of Queensland. Each of the great divisions of Australia forms a separate colony, exercising its own administration, passing its own laws and levying its own fiscal duties. There is no State Church in Australia, each of the religious sects being self-supporting. In all the Colonies education is either free or compulsory.

New Zealand comprises three main islands—the North, South or Middle and Stewart—besides a number of islets near the coast. The main islands have a length of 1100 miles. The total area of the colony is 106,240 square miles, or about one-eighth less than that of Great Britain and Ireland. New Zealand is composed of rocks of all geological ages, including large deposits of volcanic rocks. Two of the islands are traversed by great mountain chains. The climate of New Zealand is one of the best and healthiest. The lowlands are good for tillage; some parts require to be irrigated. Grains yield good returns, and sheep raising is a profitable investment. The chief mineral product is gold. The inhabitants are intelligent and industrious.

OCEANICA

OCEANICA comprises what may be called the fifth division of the globe, including the great island of Australia and a majority of the smaller islands lying between the Indian Ocean and the China Sea on one side and the Western world on the other. A sketch of Australia has already been given; others may be noticed as follows:

New Guinea was discovered by the Portuguese in 1511. It is now divided between Holland, England and Germany; the German portion is called Kaiser Wilhelm's Land.

Borneo, which, until the naturalist Wallace's explorations proved that New Guinea had the greater area, was believed to be the largest island in the world except Australia, was discovered in 1578 by the Portuguese. In 1690 they effected a settlement, but were soon driven out from it. In 1702 and 1774 England made unsuccessful attempts to

colonize the island, but of late years she has managed to acquire a controlling influence over the northwestern coast of the island.

Sumatra, Java, Celebes are among the larger single islands, while among the most important groups are the Malay Archipelago, in which these are included, and almost all of which have been subjugated by the Dutch, the Spaniards, the Portuguese and the British; the New Hebrides and Polynesia, which general terms include, among others, the Hawaiian, which is one of the most important in the Pacific Ocean. In 1829 the independence of these islands was acknowledged by the United States, who were followed in 1843 by the British and in 1844 by the French. Queen Liliuokalani, who succeeded Kalakaua, was deposed in 1894 and a republican form of government was adopted.

New Caledonia, an island lying to the east of Queensland, was taken possession of in 1853 by the French, who established there a naval station and a penal colony, which are still maintained.

New Zealand was first visited by the Dutch navigator Tasman in 1642. A colony was first established in 1840. Gold fields were discovered in 1857 which brought a large immigration. Executive authority is vested in a Governor appointed by the Crown; there is also a General Assembly consisting of a Legislative Council and a House of Representatives.

Tasmania, formerly known as Van Dieman's Land, ceased being a penal colony in 1853, since which time its population and prosperity have largely increased. A Governor appointed by the Crown holds the executive; there are also a Legislative Council and a House of Assembly.

VENEZUELA

COLUMBUS on his first voyage discovered the Paria coast on the 31st of July, 1498. The next year the whole Venezulean coast was skirted by Ojeda and Amerigo Vespucci, and the name "Little Venice" was given to an Indian village built on piles (as is common) on the shores of Lake Maracaybo; this is the origin of "Venezuela," the name now of the whole country.

In 1527 the territory of Coro was pledged by Charles V. to the Welsers of Augsburg, whose governors and adventurers had eyes and thoughts only for gold and the fabled **El Dorado**. In 1558 the Crown resumed possession; Caracas was founded in 1567, and in 1578 became the seat of government.

During the 17th century the attentions of the Crown were limited to extracting as much revenue from the colony as possible, while the people entered earnestly on agriculture and stock raising, and the various religious orders arrived and partitioned out the territory among themselves.

But the next century saw the beginning of troubles. The government insisted on all trade being carried on with Spain alone, and ultimately with only one city—first Seville, then till 1778, Cadiz. Legitimate commerce dwindled away, and smuggling by the

Dutch and English alone interfered to keep down the enormous prices of European goods. The first revolt occurred in 1749; other outbreaks kept the land in a ferment, until in 1810 the revolution began which ended in the independence of the country and the withdrawal of the royal forces in 1821.

From 1870 to 1877 the "Illustrious American," General Guzman Blanco, was first dictator and then president, and did much to rescue the country from its embarrassments. Joaquin Crespo is the present ruler.

There has never been any agreement between Great Britain and Venezuela as to the boundary line between the latter country and British Guiana. The Venezuelan Government represented to ours at Washington that Great Britain was disposed to make encroachments and claim territory that did not by right belong to her.

In December, 1895, President Cleveland sent a strong message to Congress on this subject, in which he took occasion to assert in very plain terms the Monroe Doctrine. A United States Commission of inquiry on the boundary question was appointed. Great Britain furnished the Commission with all information that could be of service in reaching a just and equitable conclusion. The result was an Anglo-American Venezuelan boundary treaty which was ratified at Washington, June 14th. Venezuela granted territory, with privileges, to Great Britain, February 9th, 1898.

BRAZIL

ALONG the sea coast and banks of some of the rivers, besides some extensive tracts in Minas-Geraes, the country has been brought under cultivation; but by far the greater portion of the surface remains in a state of nature. The dense forests furnish almost every variety of useful and ornamental timber, more than one hundred species of palms, logwood, mahogany, Brazil, and numerous other dye-woods, with sassafras, sarsaparilla, ipecacuanha, and a great variety of other drugs. Cocoa is an indigenous product; maize, sugar, coffee, cotton, rice, wheat and tobacco, have been introduced by European culture.

The animal as well as the vegetable products here present the greatest diversity. The diamond mines of Minas-Geraes are at present the most productive known. Other gems, and large quantities of gold, besides silver, copper, iron and platinum, are among the mineral riches of the same province. Manufactures in Brazil are confined to cotton-weaving, tanning, and the production of goods of primary necessity.

Brazil was discovered on the 26th of January, 1500, by the Spaniards under Pinzon, one of the companions of Columbus. In the same year the Portuguese fitted out an expedition to follow up the successful discoveries of Vasco de Gama in the East, and finally took possession of the country in 1640.

In 1808 the royal family of Portugal was expelled by the French and took refuge in Brazil, and the first act of Dom Joao VI.,

was to open Brazilian ports to foreign commerce. Other wise and liberal measures greatly stimulated the growth of the country. In 1822 he was succeeded by his son who was proclaimed and crowned Emperor as Dom Pedro I. His reign, however, was not a fortunate one. Vexed with the opposition he encountered he abdicated in 1831 in favor of his eldest son Dom Pedro II.

After a brief government by regencies, Dom Pedro II. was crowned in 1840. He proved to be a wise and liberal ruler and was popular with his people until the revolutionary disturbances of 1895, when he fled to Europe where he soon afterward died. The population of Brazil is 14,000,000, and a good deal of enterprise is shown in developing the resources of the country.

PERU

PERU is, for the most part, of igneous formation and contains a number of active volcanoes, that of Omati being the principal. Earthquakes are frequent and violent. Lying off the coast near Callao are the Chincha Islands, which, with those of Guadafe and Macabo, yield guano in vast quantities. Agriculture is much neglected, although the land is productive of excellent coffee, cocoa, cotton; besides drugs, tobacco, pimento, dyestuffs, etc. The chief articles of export are, after guano, gold, silver, wine, sugar, quinine, wool, etc.

When Pizarro, at the head of a small band of Spanish adventurers, first landed on the shores of Peru, 1532, he found it governed by sovereigns called Incas, who were looked up to by their subjects with awe and veneration; and the inhabitants were distinguished for their mild and polished manners. But the avarice of their European conquerors led to scenes of blood and desolation; the last Inca, Atahualpa, was put to death, and the Peruvians became the victims of the most unheard-of cruelties.

After being for nearly three centuries a Spanish viceroyalty, Peru, in 1821, along with the rest of Hispaño-America, achieved its independence. In 1864, the Spaniards seized the Chincha Islands until Peru should make reparation for injuries inflicted upon Spanish subjects, and held them till 1866, when Peru agreed to pay an indemnity of 60,000,000 reals. This treaty was not ratified, and an alliance entered into with Chile. After war for nearly three years, peace was restored in 1869 by the intervention of the United States. In 1881, war broke out between Peru and Chili, resulting in the defeat of Peru, and the occupation of portions of the country by the Chilean army.

As a Republic.

On June 3, 1886, General Caceres, who had gallantly defended his country against the Chilians from first to last, became constitutional president of Peru. His policy was retrenchment and the protection of the Indian population. Payment of interest of the foreign debt had become impossible. General Caceres served his term of office, and was peacefully succeeded as president, on August 10, 1890, by Colonel Don Remijio Morales Bermudez. Peru is thus slowly

recovering from the disastrous effects of a great calamity.

The natural resources of the country are being developed, a greater interest is taken in public affairs, and with a more stable government, supported by the popular will, there is reason to predict a bright future for Peru.

CHILI

THE backbone of this country is found in the Great Cordillerras of the Andes, here attaining an average height of 14,000 feet, many of whose peaks are volcanic, notably that of Aconcagua (the highest Andean summit), which has an altitude of 23,910 feet above the sea. The coast-line presents steep and rocky shores, broken into by some excellent harbors. The rivers and lagoons are so small as to be undeserving of mention. Climate healthy, taken, as a whole; a scarcity of rain is, however, often felt. Earthquakes are of common occurrence; the last great shock doing much damage in 1868.

Chili is one bed of metals: silver, gold, lead, and iron are found largely and worked; copper, however, is the principal resource of the national wealth, and is mined by Englishmen on an immense scale. Sulphur, antimony, zinc, manganese, alum, nitre, salt, coal, are other mineral items which influence a large exportation. The soil is of varying fertility, fattening most towards the South and the foothills of the Andes.

Many hard woods are made useful, instead of iron, and the fruits of the temperate zone thrive excellently. The Chileños have thriven greatly since their emancipation from Spanish rule: the bulk of commercial transactions is carried on with Great Britain.

Valparaiso is the chief port, Santiago is the capital; Valdivia, Concepcion, Talca are among the largest and finest towns. The government is formed on the constitution of 1833, and consists of three departments—the executive, legislative and judicial. The first is in the hands of a president, whose tenure of office is five years; the legislature consists of a Senate and Chamber of Deputies. The state religion is the Roman Catholic; other religions are tolerated, but their public exercise is not allowed. Chili, before the Spanish irruption, belonged to the Incas of Peru; in 1535–1540, its whole extent, excepting only Araucania, was conquered by the lieutenants of Pizarro. It thenceforward become a Spanish colony, until 1817, when, after a seven years' war with Spain, the victory of Maypú, gained by General San Martin, secured the independence of the country. At present Chili is the most flourishing of all the Hispaño-American republics.

Climate and Scenery.

The temperature of Chili is remarkably even and pleasant and always cool at nights. In the south it is dry for about eight months in the year and rainy the other four. Vines grow well on the hillsides and are a source of large income. The Andes are almost everywhere visible, covered with perpetual snow. There are many volcanic peaks, mostly extinct. Chili is subject to frequent shocks of earthquake and occasionally to

destructive tornadoes. The railway system of Chili is well developed, and in the northern provinces there are several mineral railways belonging to English companies. The Constitution of Chili is Republican and based upon that of the United States.

UNITED STATES OF COLOMBIA

FORMERLY known as New Granada, the United States of Colombia is one of the most progressive of the South American Republics. It lies in the extreme northwest angle of the continent. On the north is the Caribbean Sea; on the northeast and east, Venezuela; on the southeast and south, Brazil and Ecuador; and on the west, the Pacific and Costa Rica. Its extreme length from north to south is 1000 miles, and the extreme breadth from east to west, 760; on the Isthmus of Panama, however, the breadth is but 28 miles. It has an area estimated at from 480,000 to 520,000 square miles. The population by the last census was 2,880,633. Of these, rather less than a million are whites, and about an equal number have a large admixture of Indian blood. The remainder are civilized Indians, mulattoes, savage Indians, and the various crosses between whites, Indians and negroes.

The form of government established by the constitution of 1863 resembles in many respects that of the United States. The president is elected for two years. The Senate consists of three members from each of the states, and the lower house of delegates from the several states, each sending a member for every 50,000 inhabitants. Each state has its own legislative and executive officer.

CENTRAL AMERICA

UNDER the head of Central America the countries embraced are the Republics of Guatemala, San Salvador, Honduras, Nicaragua and Costa Rica. They declared their independence September 21, 1821, and separated from the Mexican confederation July 21, 1823. The states made a treaty of union between themselves March 21, 1847. There has been among them since much anarchy and bloodshed, aggravated greatly by the irruption of American filibusters under Kenny and Walker, 1854–5.

In January, 1863, a war began between Guatemala (afterward joined by Nicaragua) and San Salvador (afterward supported by

Honduras). The latter were defeated at Santa Rosa, June 16th, and San Salvador was taken, October 26th; the President of San Salvador, Barrios, fled, and Carrera, the dictator of Guatemala, became predominant over the confederacy. General Barrios, President of Guatemala, attempts the union of the five states, himself to be dictator, opposed by all except Honduras, February. He is defeated and killed in a prolonged battle at Chalchuapa, April 2d; peace with the states signed April 16, 1885.

CUBA

"GEM of the Antilles," as Cuba has long been called, it is at once the largest, most picturesque and inviting of all the West India Islands. Here are scenes of tropical loveliness, plantations with fertile soil and thrifty products, flourishing towns and beautiful harbors, a mixed population comprising all social grades and all degrees of intelligence.

The insurrection going on in Cuba in 1895 and 1896, aroused the sympathies of the American people. Spain sent a large army to beat back the rising tide of patriotic impulse and hold the island still under her domineering rule. Secret expeditions were fitted out from the United States, and the sympathy for the Cuban cause expressed in Congress stirred the hot blood of the proud Castilian and mobs in different parts of Spain assaulted and dishonored the American flag.

Cuba was discovered by Columbus in 1492. The Spanish settlement was consummated in 1512, and the culture of sugar-cane and tobacco introduced about 1580. American filibustering expeditions against the island occurred in 1850–51, both of which ended disastrously to their projectors. Owing to the oppressive rule sanctioned by the home government, the island broke out into revolt in September, 1868, and her people, declaring their independence, formed a so-called National Junta, and appointed Don Manuel Cespedes their commander-in-chief.

Years of Warfare.

A sort of guerrilla warfare was thus initiated, and carried on until 1878, marked by random engagements and resultant massacres on both sides. Since October, 1868, about 90,000 soldiers have been sent to Cuba from Spain, of whom scarcely 15,000 survived. In addition to these, nearly 100,000 were sent in 1895–96.

The soil is fertile in the extreme; forests of vast extent are interspersed over the interior, presenting a vegetation almost unequalled for luxuriance and variety. The climate is hot and variable; hurricanes and shocks of earthquake are frequent. Sugar is the chief staple followed by tobacco, coffee, rice, maize, tropical fruits and vegetables.

The struggle of Cuba for independence culminated in war between the United States and Spain in 1898. The destruction of the United States battleship Maine in the harbor of Havana aided in precipitating the conflict. The Spanish fleet at Manila was destroyed by Admiral Dewey and later the city was captured. The destruction of the Spanish fleet at Santiago by the North Atlantic squadron and the victory of the American forces on land was followed by a treaty of peace. Cuba became free, under a protectorate by the United States. A republican form of government was adopted and on December 31st, 1901, Senor Thomas Estrada Palma, candidate of the National party, was elected president.

HAWAII
OR
THE SANDWICH ISLANDS

UNUSUAL interest was awakened throughout America by the agitation in Hawaii, or the Sandwich Islands, which resulted in the overthrow of the monarchical government and the establishment of a Republic.

In 1843 the independence of the government was formally guaranteed by the English and French. A line of monarchs followed, the last male member of which was King Kalakaua, who died at the Palace Hotel, in San Francisco, January 20, 1891.

It was his travels and extravagance that caused the financial troubles which led to a change in the form of government. Princess Liliuokalani, who succeeded her brother, proved herself to be an erratic and self-willed ruler. She was constantly at variance with her legislature and advisers, and in January, 1895, attempted to promulgate a new constitution, depriving foreigners of the right of franchise and doing away with the existing House of Nobles, at the same time giving herself power of appointing a new house. This was resisted by the foreign element of the community, who at once appointed a committee of safety consisting of thirteen members, who called a mass meeting of their class, at which twelve or fifteen hundred persons were present.

The Queen Condemned.

That meeting unanimously adopted resolutions condemning the action of the Queen and authorizing a committee to take into further consideration whatever was necessary to protect the public safety. The committee issued a proclamation to the Hawaiian people, formed itself into a provisional government, took possession of the national property and sent commissioners to the United States, inviting this republic to annex the islands A treaty to that end was proposed by President Harrison in February, 1893.

When Mr. Cleveland entered upon his second administration he set this treaty

aside and was openly accused of expressing sympathy with the party who favored the retention of the Queen upon the throne. The new form of government, however, has existed, and the islands are now under its control.

The Sandwich Islands are thirteen in number, the eight principal of which are inhabited, viz., Hawaii, Oahu, Maui, Molokai, Lanai, Nihau, Kahoolani and Atuai. Hawaii, the largest of the group, contains the capital. Honolulu has an area of about 4000 square miles, and embraces within its limits two of the largest volcanic mountains in the world—Mouna Loa and Mouna Koa—each with an elevation of about 14,000 feet above the sea. These islands are very fertile, producing grain, coffee, sugar, cocoa, arrow-root, tobacco and fruits; while on their fine pastures great quantities of cattle are reared to supply the needs of merchant-vessels.

The Sandwich Islands constitute a calling place (Honolulu) for the mail-steamers which ply between San Francisco, Japan and China. The inhabitants are of the pure Polynesian (Malay) type. Discovered by Captain Cook in 1778, they were erected into a constitutional monarchy in 1840.

Lying as they do in the middle of the Pacific Ocean, the Hawaiian Islands, though within the tropics, enjoy a fairly temperate climate. Rains, brought by the northeast trade wind, are frequent on the side of the mountains which faces that quarter, but on the other parts of the islands little rain falls, and the sky is generally cloudless. The yearly rainfall at Honolulu, being on the leeward side of Oahu, is under forty inches; that of the islands generally about fifty-four inches.

The soil, whose constituent parts are mainly scoriæ, decomposed lava and sand



THE GRAND MAUNA LOA IN ACTION.

is generally thin and poor, but at the bases of the mountains and in the valleys there are extensive tracks as fertile as they are beautiful. In Hawaii alone, on the Waimea plains, thousands of sheep of the merino breed find grazing ground; and on most of the islands, while the upland slopes of the mountains are clothed with dense forests, the lower levels spread into grassy plains rich with sugar and rice plantations.

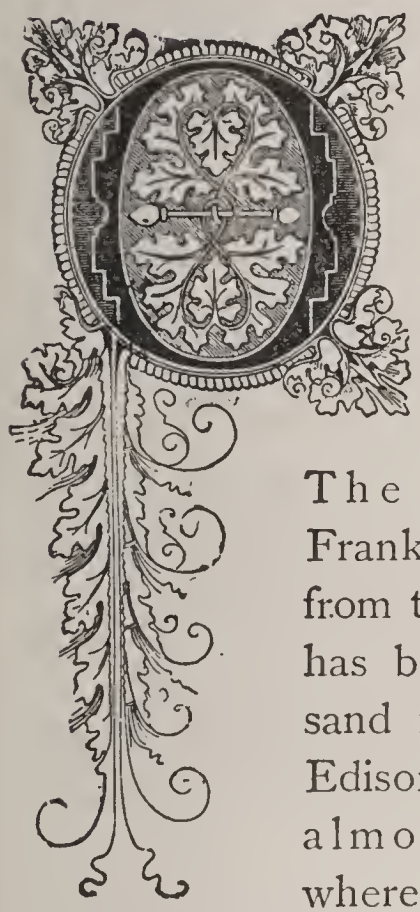
The islands are separated from other lands by a broad expanse and great depth of sea, consequently their natural history has many special features of its own. In the high mountains there are some species of plants akin to those of the American continent. The forest trees are mainly to be found on the windward, being the rainy side of the mountain ranges. Tropical fruits are numerous. There are now, as has been stated, numerous sugar and rice plantations on the islands.

The staple food of the natives consists of *poi*, a kind of thick paste made from the root of the taro plant and raw or dried fish. The only indigenous animals are rats, mice, bats, dogs and hogs, but others have been added since white men came to the islands; cattle, sheep, etc., having been introduced by Vancouver and other navigators. There are large numbers of semi-wild horses in the kingdom, and in some parts of the mountains wild dogs are also to be found.

Reptiles are few, including on land one species of the lizard and a few of the gecko; and the native birds, of which there are nineteen species, are rapidly disappearing, though foreign importations more than supply their place. The archipelago has unfortunately no mineral resources. Coral rock is the material chiefly used for building purposes, and to a less extent, basalt, compact lava and sandstone. There is a large variety of sea-shells, some of which are of exquisite beauty and loveliness.

ELECTRICITY

Latest Discoveries



In late years the science of electricity has made strides so rapid as to surprise even those who are constantly looking for wonders in scientific discovery. The achievement of Ben Franklin in drawing lightning from the clouds with his kite has been surpassed a thousand fold. The triumphs of Edison, Bell and others read almost like miracles, and whereas it was once supposed that electricity was little else than a destructive force, it has now been caught, tamed, harnessed and made to work for the good of man.

The electric light, illuminating the streets of every city; the telephone, repeating what you say here at a point miles distant; the phonograph, speaking, singing, reproducing sounds of every description; the kinetoscope, exhibiting the motions of actual life; the megaphone, sounding its trumpet blast far beyond the natural reach of the human voice; the application of the mysterious force of electricity to the uses of ordinary travel, such as street cars, and even railways hitherto operated by steam—these are only a few of the wonderful inventions and applications of the subtle agent which has suddenly leaped from the clouds and seems to be almost transforming the face of the earth.

If a stick of sealing-wax is rubbed vigorously with a woolen cloth, it will be found capable of attracting small shreds of paper. This is the simplest experiment in electricity. Many other substances, such as resin, vulcanite, glass, etc., can be made to show the same phenomenon. To obtain the best effect with any given substance a particular rubber must be chosen. For example, a cat's fur, slightly warmed, is every efficient in electrifying vulcanite or resin, while silk, amongst simple substances should be used to excite glass.

A Powerful Agent

Thus, in a simple manner, we discover in nature the existence of an invisible force. Its power may be said to be unlimited. It can shatter the stateliest granite column. It can rive in twain the brawniest oak. It can destroy instantly every form of animal life. Not until within a comparatively recent period has this force been mastered and made to work out beneficent results.

In a general way it may be said that in using electricity it is produced by friction, and stored as water might be in a tank and then the force is turned on when the power is required. All else relates to the construction of the necessary apparatus.



MR. EDISON TALKING INTO THE PHONOGRAPH.

The Phonograph

VERY few even of those who have heard the dulcet strains of some sweet song from the depths of the phonograph, understand in the least the mechanism by which the sounds are produced. The explanation is as follows: The phonograph is composed of a metal cylinder covered with a thin layer of wax, on which a pointed pen inscribes tracings, corresponding to the vibrations caught by a membrane placed on top of the pen.

The wax-coated cylinder is rapidly revolved by means of an electric battery, and as one speaks in front of the membrane, the cylinder advances slowly in a horizontal position, at the same time revolving rapidly.

The membrane vibrates much or little, according to the sounds emitted by the operator. The pen moves according to the vibrations, and peculiar, almost imperceptible tracings on the wax are the result. On top of the membrane is a funnel into which the operator speaks. The picture shows Mr Edison talking into this funnel.

To obtain reproductions of the sounds as inscribed on the wax cylinder, it is replaced in its original position. Another pen of different construction than the first is put into play, and in a most exact and delicate manner transfers to the wax of another cylinder the tracings on the first. The funnel is replaced by a rubber tube having two, four or six branches, according to the number of the auditors, and the tubes are applied to their ears, as in the illustration.



LISTENING TO SOUNDS FROM THE PHONOGRAPH.

Not only can we hear the sounds from the same phonograph into which they are spoken, but the cylinders may be preserved and taken wherever we wish; by placing them again in a mechanism as above described, the original sounds may be reproduced.

In this manner are made the phonographs found in many hotels and public places. The first cylinder is carefully made as above described, and duplicated as many times as required. Each cylinder is then placed in a case, and the phonograph may be put in use when required.

The new and perfected Edison phonograph has already gone into very general use and many thousands are distributed in American business offices, where they facilitate correspondence in a variety of ways. They are also employed by stenographers as a help in the transcription of their shorthand notes. Heretofore these notes have been slowly dictated to amanuenses, but they are now frequently read off to a phonograph and then written out at leisure. The phonograph is, however, being used for direct stenographic work and it reported verbatim forty thousand

words of discussion at one presidential convention, the words being quietly repeated into the machine by the reporter as quickly as they were uttered by the various speakers. A large number of machines are in use by actors, clergymen, musicians, reciters and others, to improve their elocution and singing. It is also worthy of note that voice records remain of distinguished men, who "being dead, yet speak."

Why the Wheels Go Round

FEW people understand the principle upon which street cars are propelled by what is known as the Trolley system. Most people know that a power-house, a trolley wire and a motor are necessary to the system, but of the functions of the various parts they have but a faint conception. "What makes the wheels go round" is a mystery, yet it can be easily explained.

First, there are boilers to generate steam for the engines, and the engines in turn drive the generators, which produce the mysterious power or "juice," as it is commonly called by the electricians, for the motors in the cars. It is obvious, therefore, that the prime factor in the operation of an electric railway is steam, the electric current acting only as a convenient and subtle agent for transmitting and distributing the power.

The voltage of an electric circuit corresponds to the pressure in water pipes. The voltage of a dynamo depends on three conditions, namely, the speed of revolution of the armature, the number of coils of wire in the armature, and the strength of the magnetic field. For incandescent lighting, 110 volts are generally used, while for railways the pressure is 500 volts.

The current from the generator in the power-house goes to the switchboard, where it passes through an ammeter, which indicates the amount of current being given out, through a switch, by means of which the current may be shut off at will, and through a circuit-breaker, which opens the circuit automatically in case of a short circuit on the line or an overload.

From this point one side of the circuit is composed of the feeder (heavy insulated copper cables) and the other side of the ground or return. Formerly the rails alone connected with the ground formed the return, but owing to various causes, among them the electrolytic action on water and gas pipes, the modern practice is to supplement the rails with heavy copper wires, which afford an easier path for the current than the pipes. The feeders run parallel with the tracks, either overhead or underground, as the case may be, and at points along the line are "tapped" or connected to the trolley wire.

How the Current is Applied.

Each car is provided with two motors, the armatures or revolving parts of which are connected to the axles of the cars. A motor is made almost exactly like a generator. In fact, if driven by an engine, it will generate an electric current the same as the generator. Therefore, when the power of the engine drives the armature of the generator in the power house, causing it to give out a current, this current supplied to the motor causes its armature to revolve and develop the same mechanical power originally required to drive the generator, eliminating, of

course, the various losses due to friction and leakage.

Next the current goes through the motor. While delivering a lecture before an audience of unskilled laymen, a well-known electrical engineer was asked how the current gets into the car, and he replied: "The conductor brings it in." Of course he meant the copper conductor running down the trolley pole, and not the innocent fare-taker and bell-ringer.

Practical Illustration.

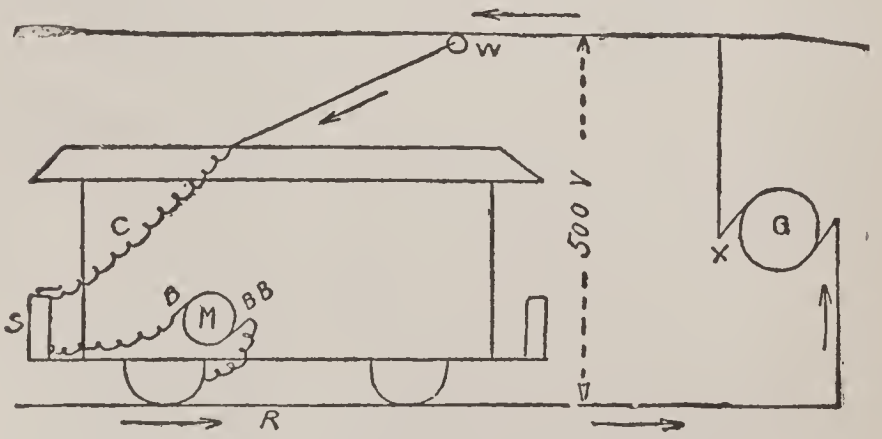
The method of allowing the current to pass through the motor in the car is illustrated in the annexed sketch. The top line is the trolley wire and R shows the rails. Between these there is maintained a pressure of 500 volts. W is the trolley wheel in contact with the trolley wire, and attached to the trolley pole. In electrical contact with the trolley wheel and running through the trolley pole is an insulated copper wire C. This wire is shown in the sketch, but is, of course, concealed in the car. It runs to the familiar metal case on the platform. This case contains the controller, which consists of a system of coils of wire, resistance arranged so that the speed of the motors may be varied by the motorman by turning the switch or controller handle to different points.

The controller is also so constructed that by turning another handle the motor will revolve in the opposite direction, backing the car. The coils are so arranged that the two motors may be thrown in parallel or in series, which means in the first case that each motor completes a circuit by itself, while in the second case the same current flows through both motors. Only one motor is shown in the sketch, which is sufficient to illustrate the principle

The direction of flow is shown by the arrow heads. The current from the generator G in the power house flows to the feeders and trolley wire. From the trolley wire it flows through the trolley wheel W, through the wire C in trolley pole to the controller S, where it is turned on or off by means of the controller handle. From here it flows through another wire to the brush B of the motor M, through the armature of the motor and out at the brush B B, then through a wire into the car wheel to the rail R, which carries the current back to the negative brush of the generator G.

Great Motive Power.

The flashing often seen at the wheels of an electric car is caused by imperfect contact between the wheel and rail, and is due often to dust on the rail or similar causes.



Already the electric current has been applied to ordinary railroad traffic. The most advanced thought on this subject points to the time not far distant when electricity will be the great motive power superseding steam. Its advantages are evident at a glance. The speed which it is capable of furnishing, the absence of annoying smoke, the facility with which it can be operated, all indicate that its practical results will be of great service, will form an epoch in scientific discovery and constitute a new mode of carrying on those great industries which are dependent upon a motive power, at once efficient and easily manipulated.

Successful efforts have been made to place the conducting wires in the earth, thus avoiding the danger of having them over head. The advantage of this is apparent, and being accomplished, we shall have the most complete motive power ever brought into use.

The achievements thus far in electrical science are among the greatest triumphs of the age. These have come rapidly and in vivid succession. The most acute thought and inventive genius have been displayed in the practical application of this greatest and most marvelous of all the agents treasured in the storehouse of nature.

The Telephone

SUPPOSE you want to communicate with your neighbor across the street: a wire is stretched between the two houses and connected to the two telephones; from the remaining binding screw of each telephone wires are conducted, say, to the gas-pipe, and the *bare* wire wound round the *bare* pipe, brass pipe, as the joints of the latter sometimes intercept altogether the flow of electricity.

Philosophy of the Telephone.

We already know that when sound-waves impinge on anything like the ferrotype plate of a telephone, such a plate is made to vibrate; and a piece of iron like this vibrating in the neighborhood of a magnet will considerably disturb its lines of force. If these fluctuating lines of force, therefore, are crossed by rings of wire, currents of electricity will be generated in the wire.



COMMUNICATING BY TELEPHONE.

so that there may be metallic contact. Conversation may now be carried on as in the annexed figure. For short distances you will perhaps find least difficulty by using a double wire instead of connecting to the

And so it is every time one speaks into a telephone, for electricity is generated and sent along the wire to the other end, in a direction which varies with the "in-and-out" action of the telephone plate.

You will clearly see, then, that electricity is produced at the *transmitting* end. What happens where the listener has his attentive ear to the telephone? The electricity travels round the coil of the *receiving* telephone, and varies the magnetism of the bar within it, which in its turn varies its attraction upon the ferrotype plate; the ferrotype plate begins to vibrate, and it vibrates in such a way as to reproduce the sounds which were spoken into the transmitting end.

Transmission of Sound.

That we should ever be able to "talk by lightning" was not dreamed of for many years after the discovery of the telegraph proved that messages could be transmitted through motions of the electric instrument producing signs. Now we do not have to write the communication, but can speak to a person many miles away, and converse almost as freely as we would with one by our side in the same room.

The principle is that of the transmission of sound. The air, the water, woods, metals are all conductors, but it has been proved that a metallic conductor, a telegraphic wire, with electricity for the driving force, is the best transmitter ever discovered. The telephone has rapidly sprung into use, and has become a necessity in our large towns, where, on account of the pressure of business, time is money and moments count for as much as hours did once. A man of business can call up his neighbor, who is near or his customer miles away, and in a brief time the matter in hand is disposed of.

The description of the instrument is as follows: An electro-magnet or spool of copper wire is fastened to the end of a steel bar which has been charged with magnetism; the ends of the wire are carried down to the outer part of the rubber case, and connected by screws to the line wire.

In front of the spool, and a little way from the end of the bar magnet, a piece of "ferrotype" sheet iron is placed. When a

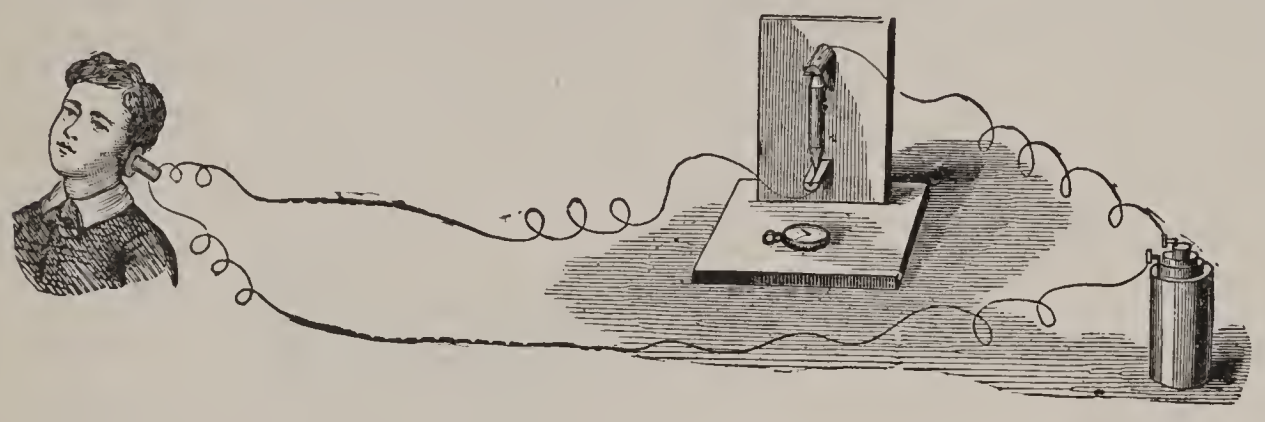


THE BELL TELEPHONE.

current of electricity is sent into the telephone and through the spool of wire, thn sheet iron plate is caused to vibrate in unisoe with the breaking of the current, by reason of the alternate attractions and cessations of attraction of the plate by the electro-magnet, and a sound is produced, as already explained.

The microphone is an instrument for intensifying and making audible very feeble

sounds. It produces its effects by the changes of intensity in an electric current, occasioned by variations in the contact resistance of conducting bodies. It has always been known that many solids are excellent conductors of sound. One of the little experiments of boyhood is for one lad to hold his head under water while another, not far away, strikes two stones together under the surface. The water coming in close contact with the ear, and being a good conductor of sound, produces something in the nature of a shock, quite as startling as would be the firing of a pistol near one's head. This, it must be understood, is not the principle of the microphone or telephone. There must be a conductor for the electric current, but the current itself is indispensable.



THE MICROPHONE.

Thus, not only by the telegraph can words be transmitted, but also in a more direct way, and even the tones of the human voice can be distinguished. It is literally true that we talk by lightning, and can speak to a listener a thousand miles away. Our age finds in electricity its most marvelous field of discovery.

The Electric Light

THE problem, long-studied by scientists, of procuring from this subtle force in nature a light that would be of service and outstrip all other means of illumination has been solved, and in every town now, of any dimensions, electric lighting is in successful operation.

Pure incandescence is represented by four systems—Edison, Maxim, Swan and Lane Fox. The light from this description of lamp is from the heating of a carbon filament due to its high resistance to the passage of the current. This filament is surrounded by a hermetically sealed glass bulb from which all the air has been extracted.

The life of the lamp depends greatly as to how carefully this process has been carried on. It is not sufficient only to extract the air when the lamp is cold, but the process must be carried on when the lamp is burning, and the exhaustion must be continuous for some time. These lamps can be worked either by an alternating or a continuous current machine; and, unlike those of partial incandescence, require a tension current, while the former work best with a quantity one.

The Edison lamp is generally considered to be the pioneer of this system of illumination. Whether this be so or not the name of the inventor has been for a considerable time associated with lighting by incandescence, although his early experiments were with a lamp containing a metallic substance. The lamp consists of a blown glass globe containing a very fine filament made from the fibre of bamboo carbonized. The length is fixed according to the resistance required.

Each end of the filament is nipped between a miniature vise composed of platinum

connected with the terminals of the lamp. These are fixed in an insulated socket, which also holds the glass bulb. The socket is furnished with a screw which fits into a projection on the bracket or holder, so that the act of screwing in the lamp makes the necessary connection with the conducting wires.

By turning a tap the lamp can be removed without interrupting the passage of the current. The maximum duration of the lamp is stated to be twelve hundred hours. The chief feature of the Edison system is the manner in which the inventor distributes the current from a main generator of his own design, which is always used with this system of lighting.



THE VOLTAIC ARC.

The engraving on next page is a perfect representation of Edison's latest electric lamp, with its various parts shown in detail. Fig. 1 shows the carbon horseshoe ready for use, full size; Fig. 2 represents the horseshoe when just cut from the Bristol board, illustrating, by its comparison with Fig. 1, the enormous shrinkage it undergoes during the process of carbonization.

The only index to the completion of this process is the crackling of the oxide formed on the exterior of the iron boxes in which the horseshoes are placed. After their removal from the boxes the carbons are placed between the jaws of small platinum vises, *a*, *a*, supported on thin platinum wires blown in the glass base and forming the electrodes. The resistance of the slender horseshoe is one hundred ohms.; and while the lamp shown, Fig. 3, is intended to give a light equivalent to a single four-foot gas jet, it may be forced to give a light equal to eight or ten of such jets.

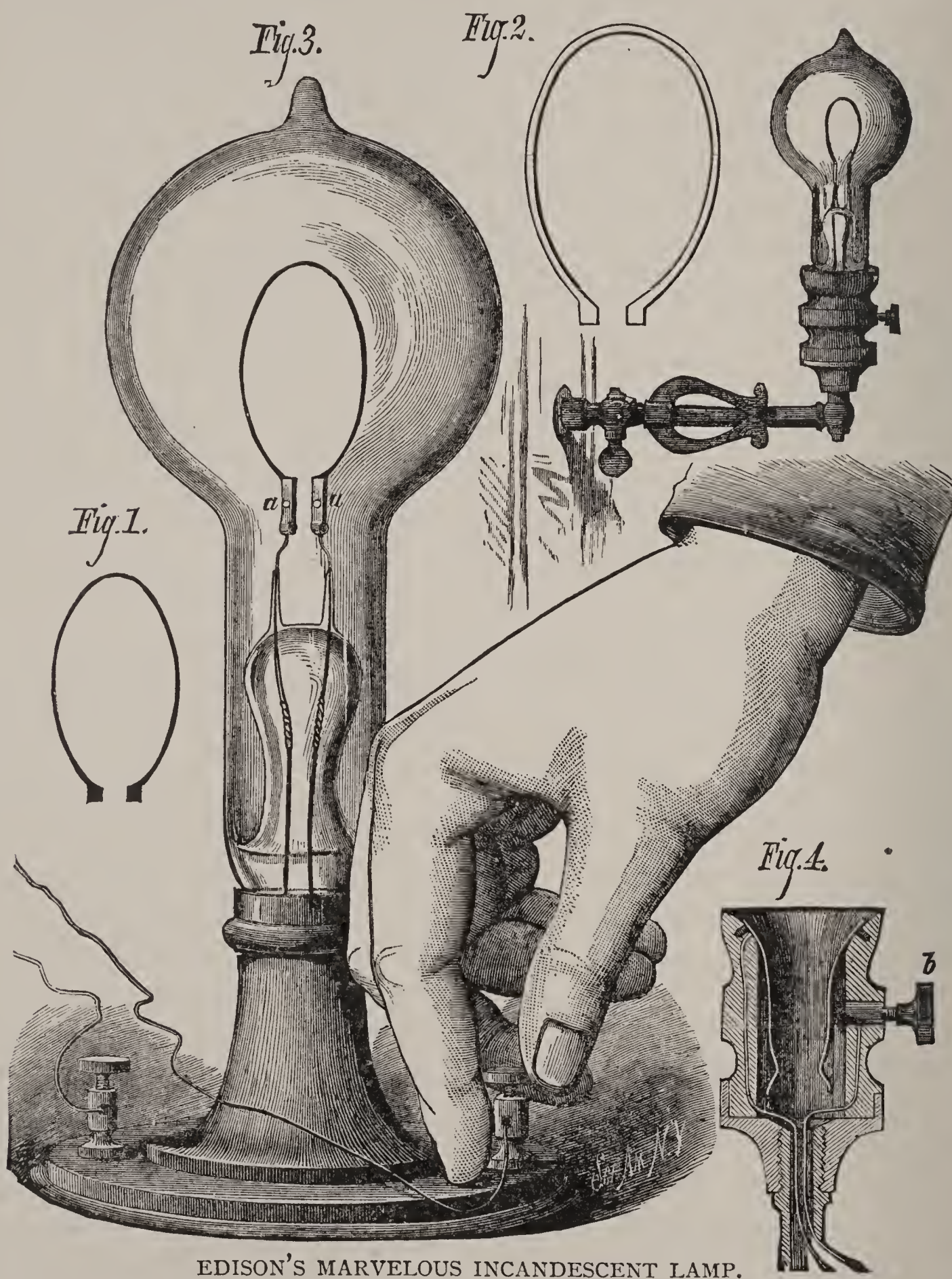
The carbons are so tough that one of them has been subjected to the test of applying and removing the electric current a number of times equivalent to thirty-six years of actual daily use, and without being in the least impaired. The horseshoe form of the carbon has a great advantage over the voltaic arc, the light being softer, more diffused and less trying to the eyes. It is, besides, perfectly uniform and steady. The lamps are connected in multiple arc, that is, the two wires leading from the electrical generator run parallel to each other, and the lamps are placed between them and are connected with each wire.

Easily Handled.

The entire lighting apparatus of any building consists in the lamps and a few wires. The lamp in its present form is as simple and as easily handled as a candle, and can be taken from its socket and replaced even while the current is on. The construction of this socket is shown in Fig. 4. The lamp has, attached to its electrodes, slips of copper which are bent up against the sides of the glass, touching two springs at opposite sides of the socket. One of these springs is connected with one of the electrical conductors; the other merely touches the copper strip, and does not form a part of the electrical conductor until it is touched by the thumb-screw, *b*, this latter being connected with the second electrical conducting wire.

To start the light it is only necessary to turn the screw, *b*, till it touches the spring. To stop the light the screw is turned in the reverse direction. From this it is obvious that an electric lamp is more easily managed

than a gas burner, as it requires neither lighting nor regulating; while it is equally plain that these lamps, having withstood the test of time, the inventor has solved a problem, and become one of the world's great benefactors.



EDISON'S MARVELOUS INCANDESCENT LAMP.

Edison's Mimeograph.

The Mimeograph was designed and patented by Mr. Thomas A. Edison. In designing the mimeograph, Mr. Edison took as his fundamental principle the stylus or point, the writing implement of man since the art was first invented. It is the natural tool by which the hand can trace characters, and it is this stylus or point, peculiar to the mimeograph in the line of duplicating machines, which created for it such a decided and permanent popularity.

With the stylus as first principle, Mr.

Edison built the mimeograph, with reference to the stylus as the writing instrument, designing the other parts to meet its requirements.

The mimeograph belongs to the stencil class of duplicating machines, which, as is well known, is the best type of such devices. The stencil is made on a sheet of fine specially manufactured tissue paper, which is coated on one side with a film of sensitive material.

Fine Steel Plate.

The cutting agent of the mimeograph is a plate of fine tool steel, upon which are cut intersecting corrugations, numbering two hundred to the inch, thus making on the plate a surface of small sharp points, so fine and minute that a magnifying glass is required to bring them distinctly to the eye; upon this steel plate, which is imbedded in a table or plate of polished slate, the sheet of sensitive paper is placed, and the stencil is formed by writing on the paper over the steel plate with the stylus, which is made of tempered steel and nickel plated.

As the steel point of the stylus (which is ground to a round or smooth point) passes over the sensitive paper, it presses the paper against and upon the steel plate, and the fine sharp points puncture it from the under side making a series of orifices or holes, each one a two-hundredth part of an inch from the next, in the lines of the writing.

The point of the stylus, although tapered to the size of a nicely sharpened lead pencil, really rests on three of the cutting points of the writing plate (as the corrugated steel is termed) at one time.

It thus glides easily and smoothly over the roughened surface without tearing the paper, but still with just enough friction to make the act of writing a pleasant operation, almost identical to that done by a medium hard lead pencil.

After the stencil is made, the next operation is to prepare the stencil sheet (as the sensitive paper is now called) for the purpose of printing copies of which it is the original.

The ink is squeezed from its collapsible tube upon a slate used for that purpose, and a hand roller made of a peculiar composition is passed over it, spreading the ink evenly over the slate, and at the same time charging the roller.

The sheet of paper upon which the copy is to be printed, is placed upon a blotter resting on the baseboard beneath the stencil sheet, and the ink roller is passed over the stencil sheet, forcing the ink through the perforations and upon the impression paper, thus making a print. This last operation is repeated until the required number of copies are obtained.

The *modus operandi* just described is for the purpose of reduplicating autographic matter.

Edison's Kinetoscope.

Perhaps the simplest statement of the principle upon which this instrument is constructed, would be to call it the reproduction of motion. The observer looks through a glass into a small cabinet and appears to see living figures. These may be men, or animals, and they are in action. Just as the phonograph makes a faithful record of sounds, so the kinetoscope gives us a reproduction of the actions of living creatures.

The following is what Mr. Edison himself says on the subject: "In the year 1887 the idea occurred to me that it was possible to devise an instrument which should do for the eye what the phonograph does for the ear, and that by a combination of the two all motion and sound could be recorded and

reproduced simultaneously. This idea, the germ of which came from the little toy called the zoetrope, and the work of Muybridge, Marie and others, has now been accomplished, so that every change of facial expression can be recorded and reproduced life size. The kinetoscope is only a small model illustrating the present stage of progress, but with each succeeding month new possibilities are brought into view.

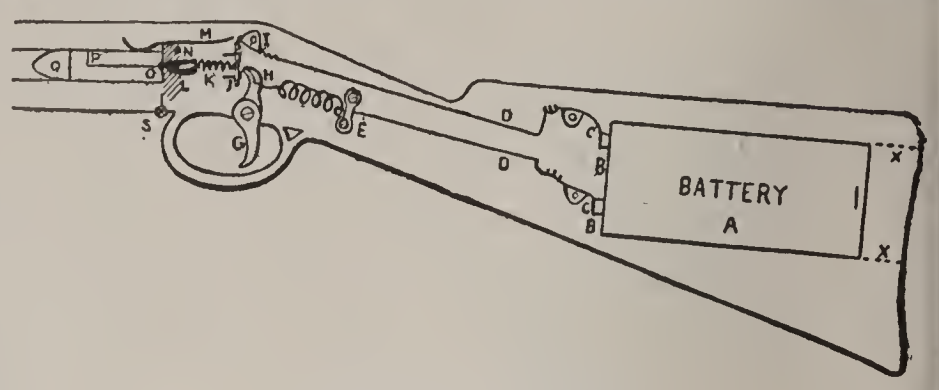
"I believe that in coming years by my own work and that of others, who will doubtless enter the field, grand opera can be given at the Metropolitan Opera House at New York, without any material change from the original, and with artists and musicians long since dead."

After the instrument was perfected the succession of pictures was found to be rapid, and those instruments exhibited in nearly all our towns are found to work most satisfactorily.

Electric Rifles.

The practice of firing big guns by electricity is already well established, but hitherto no practical attempt has been made to explode the shells of small arms electrically. An electric rifle has been designed in which it is sought to carry out this principle.

The source of the current is a battery A, which is fitted into the stock either from the side or from the ends. The holes B B are connected to springs C C, from which the wires D D run respectively to a spring M, bolted at I to the lock plate, and to the insulated hammer H fixed on the upper part of the trigger G. Q is the shell containing an insulated pin, the head of which O projects beyond the base of the shell. If necessary, two pins can be placed parallel with each other and insulated until their points nearly meet. Between the base of the cartridge and the hammer is a pin K encircled by a spring and riveted into a cross plate J at one end, the other end being fitted into an insulated thimble L, the point of which



ELECTRIC RIFLE.

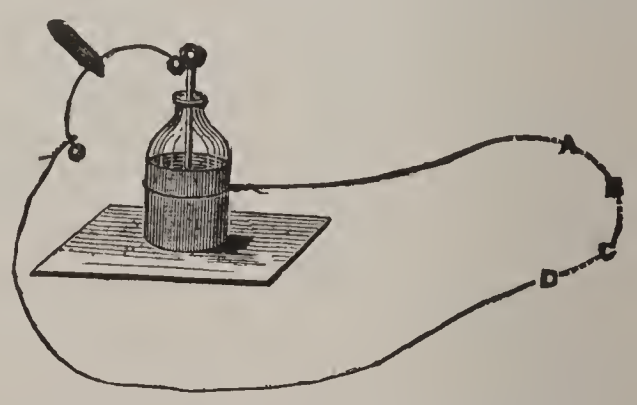
nearly touches the shell pin head O. When the cartridge has been inserted and the gun closed, the spring M rests on the metal base of the cartridge.

As the trigger is pulled, the hammer strikes the plate J forcing the point of the thimble L into contact with the projecting end O of the cartridge pin. An arc is established at P O, which explodes the contents of the cartridge.

The point of the firing pin P can be placed anywhere within the explosive powder of the cartridge, but by extending it near the bullet, as shown in the illustration, a more effective explosion of the powder is secured.

To Get an Electric Shock.

Suppose there are four persons (A, B, C and D) who are desirous of receiving the shock. A wire is wound round the outer



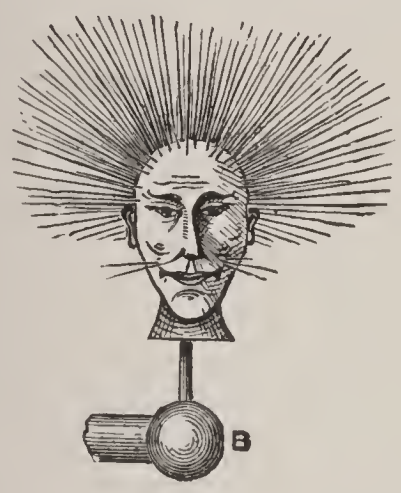
GIVING A SHOCK TO PEOPLE.

coating of the Leyden jar; the jar is then charged and placed on the table. The four persons join hands, and while A holds the

end of the wire leading from the outer coating of the jar, D has also hold of a wire which is in communication with one of the knobs of a discharger. You now seize the insulating handle of the discharger and bring *one* knob only in contact with the knob of the Leyden jar. A shock will be experienced by the four persons, and unless A be cautioned he may, by his sudden antics, pull the jar off the table.

A Singular Effect.

There are many effects, some of them odd and humorous, which can be produced by electricity. For example, place the figure of a human head, with flowing hair, on the



AN ELECTRICAL FRIGHT.

end of a rod stuck into the prime conductor. Immediately it becomes charged with electricity its hair stands on end as if it had received a terrible fright.

How Ocean Cables Are Made.

The cable consists first of a core comprising the conductor made of a strand of copper wires, and the insulating covering of gutta percha or India rubber to prevent leakage of the electric current. Outside of this is a layer of tanned jute yarn. This protects the gutta percha or rubber from the sheathing of steel wires which is the next covering, and which varies according to the depth of water in which the cable is to be laid. Outside of this again is a combination of jute yarn and a bituminous mixture. This is applied in a melted condition from a spout as the cable is passed underneath. During the time the cable is being manufactured and laid, electrical tests are taken to insure perfection.

The finished cable is then kept coiled in large circular iron tanks under water. Similar tanks are in the cable ship, and when at sea the lengths are paid out over a large pulley at the stern. The speed is regulated by several retarding wheels and a brake wheel, over and under which the cable has to pass. The strain to which it is subjected at any given moment is indicated by a dynamometer.

Method of Laying.

When all the cable has been paid out, the end is carefully sealed up and attached to a stout rope. This is lowered to the bottom of the sea and the other end of the rope is attached to a buoy which is to mark the end of the cable, which is usually laid in three sections. One laid, for instance, was started from Waterville and laid out to a given point in deep water. The second section was laid from Canso, on the American side, also into deep water, after which the fifteen hundred intervening miles were laid and all three spliced together.

But the laying of a cable is as nothing to the difficulty experienced in repairing it, especially if the work has to be done during rough weather, when the sea runs mountains high and the gales continually blow the ship away from the scene of operations. Sometimes the cable is found buried in sand several thousand fathoms from the surface of the water. When it is only a flaw and the strands themselves are whole the task of repairing it is slight; but when the cable has actually parted and both ends have to be found and again spliced together, it is sometimes a work of several months.

Famous Gems

A ROYAL gift is now in the hands of the Pope of Rome. It is a diamond, the size of which has never been equalled in the whole world, unless the story of the Braganza diamond was true. That diamond, it was said, weighed in the rough 1680 carats. The loss in cutting generally comes to one-half or a little less than two-thirds. This would make the gem weigh about 560 carats when cut. The stone was said to be worth £3,000,000 sterling or $15,000,000. What became of the Braganza is not known. It is probably now famous after successive cuttings and various owners under a name which has no association with the original finder.

Very little is yet known of the immense diamond now the property of the Pope. The meagre cable despatches from Rome said that it was found by an African chief in the mines at Jagersfontein, and is said to be the largest known, weighing in the rough 971 carats. It came into the possession of the President of the Transvaal Republic, who sent it to the Pope. It is described as being of a bluish white cast and practically perfect, the only blemish being a tiny spot, invisible to the naked eye.

What the value of this stone is can hardly be estimated. When cut the weight of the stone will be about 450 carats, and, if perfect, it should be worth the gigantic sum of $20,000,000. Large South African diamonds have not the same value that the Brazilian stones have. An eighty-carat gem is a common find in the African mines, but most of the large stones discovered there are yellow in color, which largely depreciates the value. Still, from its gigantic size, the Pope's diamond has at once taken a foremost place among the great gems of the world, and two thousand years from now it will probably be talked and written about just as the Koh-i-noor is to-day.

The Queen of Jewels.

The most valuable cut stone in the world is the King of Portugal's Brazil diamond, which weighs 525 carats and is worth, if genuine, the magnificent sum of $28,000,000.

The Koh-i-noor or mountain of light, owned by Queen Victoria, is worth $3,500,000. This brilliant is 2000 years old. The Hindoos trace it back to the time of the god Krischna. It was certainly in the treasury of Delhi, and was taken in the conquest of

that city by Ala-ed-Din. From him it came into the possession of the Sultan Baber, of the Mogul dynasty, in 1526. This prince esteemed its worth at the sum which it would take to maintain the whole world for a single day. The jewel was seen by Tavernier among the jewels of Aurengzebe, but it had been reduced by the unskillful cutting of Hortensio Borgio from 793 carats to 186, the weight it possessed at the Paris Exhibition of 1851.

The Emperor Indignant.

The Emperor Aurengzebe not only refused to pay Borgio for the cutting, so incensed was he at the great loss, but he confiscated all of his property, and was with great difficulty prevented from cutting off his head.

Nadir Shah, the conqueror of India, possessed himself of the stone by a trick; then it passed from his descendants into the possession of Achmed Shah, whose son, Shah Sujah, was forced, in his turn, to give the prize to Runjeet Singh. After the capture of Lahore, at the time of the Sikh mutiny, it fell into the hands of the British troops, who presented it to Queen Victoria in 1850.

The brilliant had an irregular form, with several hollows at the base and at the sides, and there were several fissures on the surface. After great discussion among scientists the stone was intrusted to Mr. Costen, of Amsterdam, for recutting, and the results were marvelous. Little was lost in size comparatively, and, instead of being a lusterless mass little better than a piece of rock crystal, it is now a matchless, fire-flashing brilliant weighing 10 1-16 carats, and forms a valuable part of the crown jewels of England.

One of the diamond wonders of the world is the Orloff, which is set in the scepter of the Czars of Russia. It weighs 194¼ carats. Like the Koh-i-noor it has the under side flat and is rose cut. The diamond is supposed to have formed one of the eyes of an idol in a Brahmin temple. It is also said to have been set in the famous peacock throne of Nadir Shah.

Be its origin what it may, it is certain that it was stolen by a Frenchman, who sold it in Malabar for £28,000. It was purchased by the Armenian Schaffras, who, in turn, sold it in the year 1774 to the Empress Catharine II. of Russia for 450,000 roubles, a pension of 20,000 roubles and a patent of nobility. Another beautiful diamond belonging among the Russian crown jewels is the Shah, which weighs 86 carats and is absolutely perfect, a mass of fire and brilliancy. It was presented to the Emperor of Russia by Cosroes, the son of Abbas Mirza.

Famous French Gem.

Among the other famous diamonds is the Regent or Pitt diamond, which forms part of the French crown jewels. Its weight is 136¾ carats, and its estimated worth to-day is $1,000,000. It was bought by the Duke of Orleans, then Regent of France, of Pitt, the Governor of Fort George, in the year 1717, for £135,000, in the rough stone weighing 410 carats, and the cutting cost £2000. Pitt published a pamphlet declaring that he purchased the stone in Golconda of Jamelchund, a Hindo merchant. This diamond was stolen from the Garde Meuble in 1792, but was mysteriously restored. Its final cutting occupied two years and cost £3500.

The Emperor Napoleon I. had it set in the hilt of his sword of state, and it was captured by the Prussians at Waterloo. This wonderful stone was shown at the French Exhibition in 1855.

The Empress Eugenie has a superb stone, absolutely perfect, which weighs 51 carats; it is set as a pendant, and was purchased for her by Napoleon III.

The Florentine belongs to the Emperor of Austria; it weighs 139½ carats, and it is worth $500,000. It is yellowish in color and is rather thickly covered with facets like a rose diamond. In shape it is pointed top and bottom.

Disappeared and Returned.

The noted Sancy diamond is almond-shaped; it weighs 53½ carats; it was found on the body of the Duke of Burgundy in 1479 and was bought by the King of Portugal. After many changes it finally came to James II. of England, who sold it to Louis XIV. for £25,000. It disappeared, with many other valuable things, in the dark days of the Revolution, and some years later became by purchase the property of Prince Paul Demidoff.

After the battle of Culloden the city of London purchased a magnificent diamond at a cost of $57,000 and presented it to the Duke of Cumberland. It was known thereafter as the Cumberland diamond; its weight is 32 carats. It was one of the the stones claimed by the crown of Holland.

There are perhaps 8,000 dealers in diamonds in the world who carry in their stock stones worth perhaps $350,000,000. The remainder are in the hands of private individuals. There is always something fascinating about the subject of diamonds, and rich and poor like to read about precious stones. It is estimated that during the last twenty-five years the American people have paid duty on at least $180,000,000 worth of diamonds and other precious stones. In 1893 alone they imported $15,203,563 worth, but in 1894 there was a falling off, owing to the hard times, and the total was only $4,856,895. This does not include uncut diamonds, of which we imported more than 1,000,000 worth in 1892, $800,000 worth in 1893, and $566,267 worth in 1894.

Diamond-Cutting.

In 1880 we imported only $129,000 worth of uncut diamonds, and in 1889 only $250,000 worth. The large increase of late has been due to the fact that a number of American jewelers have opened diamond-cutting establishments. There are now fifteen establishments in the United States, which employ from one to twenty men. There are 4,000 manufacturers in Europe and about 200 in the United States, who employ between 7,000 and 8,000 persons as cutters and polishers.

Perhaps 28,000 people are employed in the diamond mines throughout the world. We read that in past centuries 60,000 people were working in some single Indian mines at one time, and perhaps that statement is not exaggerated, since by the aid of modern machinery one miner can now accomplish as much as twenty who use the primitive methods. The total value of all the diamonds in the world undoubtedly exceeds $1,000,000,000.

ASTRONOMY

How to Read the Sky

THE most exact, as well as the most sublime of all the sciences, is astronomy. Where are the souls to whom the spectacle of starry night is not an eloquent discourse? Where are those who have not been sometimes arrested in the presence of the bright worlds which hover over our heads and who have not sought for the key of the great enigma of creation?

The solitary hours of night are in truth the most beautiful of all our hours, those in which we have the faculty of placing ourselves in intimate communication with Nature. The orb of day conceals from us the splendors of the firmament; it is during the night that the panoramas of the sky are open to us. At the hour of midnight, the heavenly vault is strewn with stars, like isles of light in the midst of an ocean extending over our heads.

In the vaporous darkness our eyes gaze freely on the sky, piercing the deep azure of the apparent vault, above which the stars shine. They traverse the white constellated regions, visiting distant realms of space, where the most brilliant stars lose their brightness by distance; they go beyond this unexplored expanse, and mount still higher, as far as those faint nebulæ whose diffused brightness seems to mark the limits of the visible. In this immense passage of sight thought is carried away by its flight and wonders at these distant splendors.

It is then that thousands of questions spring up in our minds, and that a thousand points of interrogation rise to our sight. The problem of creation is a great problem! The science of the stars is a sublime science; its mission is to embrace all created things! At the remembrance of these impressions, does it not appear that the man who does not feel any sentiment of admiration before the picture of the starry splendor, is not yet worthy of receiving on his brow the crown of intelligence?

No one can study the human frame, its marvelous bones, joints, muscles, arteries, nerves; its breathing lungs and beating heart, sending its thrill of life through every fibre of the complicated system, without being led to the thought of an all-wise Creator. Far more true is it, if possible, that "an undevout astronomer is mad."

Of all the sciences astronomy is the one which can enlighten us best on our relative value, and make us understand the relation which connects the earth with the rest of creation. Without it, as the history of past centuries testifies, it is impossible for us to know where we are or who we are, or to establish an instructive comparison between the place which we occupy in space and the whole of the universe; without it we should be both ignorant of the actual extent of our country, its nature, and the order to which it belongs. Enclosed in the dark meshes of ignorance, we cannot form the slightest idea of the general arrangement of the world; a thick fog covers the narrow horizon which contains us, and our mind remains incapable of soaring above the daily theatre of life, and of going beyond the narrow sphere traced by the limits of the action of our senses.

A Universe of Wonders.

On the other hand, when the torch of the Science of the Worlds enlightens us, the scene changes, the vapors which darkened the horizon fade away, our mistaken eyes contemplate in the serenity of a pure sky the immense work of the Creator. The earth appears like a globe poised under our steps; thousands of similar globes are rocked in ether; the world enlarges in proportion as the power of our examination increases, and from that time universal creation develops itself before us in reality, establishing both our rank and our relation with the numerous similar worlds which constitute the universe.

The sun, which so many have worshiped, and which is, humanly speaking, the source of life to us all, is a perpetual wonder. Its circumference is about two million seven hundred and seventy thousand miles. Its distance from the earth is so great that a railway train moving at thirty-two miles per hour would take three millions of hours, or three hundred and forty-two years and three months, to travel from us to the sun, supposing that it could travel incessantly night and day during that time. When arrived, it would be rather more than a year and a half in reaching the sun's centre; three years and a quarter in passing through the sun, supposing it was tunnelled through, and ten years and one-eighth in going round it. How great these dimensions are, may be conceived from the statement, that the same train would attain the centre of the earth in five days and a half, pass through it in eleven days, and go round it in thirty-seven days. A cannon ball, moving fifty times faster than such a train, would expend seven years in reaching the sun.

Vast Size of the Sun.

To make a globe like the sun it would take one million four hundred thousand globes like the earth rolled into one! Or, to make these facts simpler, and yet more stupendous, the bulk of the sun is five hundred times greater than the aggregate bulk of all the other bodies of the solar system of which night only reveals to us a small part —that which appears above our hemisphere and above our particular standpoint. The centre of the sun is a dark mass covered with a garment of flame. But in this luminous matter there are vast rents. We talk of spots on the sun; spots indeed! the space occupied or laid bare by the principal spot is nine hundred and twenty-eight million square geographical miles.

Arago, by a physical test, proved that this garment of flame, this luminous matter, must be gaseous; so that the sun floats in an ocean of flame, and this is so powerful that the strongest blast furnace yet ignited by man, at its highest power, is seven times

weaker than the sun's heat at its surface. If the heat be electric, how great is the wonder! being dispersed over space so great that the earth's surface, at a distance of ninety-one million miles, notwithstanding the alternation of night, receives in a year sufficient, if uniformly diffused, to liquefy a crust of ice one hundred feet in thickness.

When we come to examine the sun by the aid of a telescope, we find that all parts of the surface do not give out light to the same extent, and that there are certain places on it darker, and some brighter, than the remainder of the disk. The former are sunspots, the latter faculæ.

The Sun Revolves.

The first person who examined sunspots closely was the illustrious Galileo, who proceeded to determine from them the sun's velocity of rotation on his axis; for he perceived that they moved across the sun's body. However, since his time, it has been shown that the spots have a motion of their own; those at the sun's equator moving faster than those at his poles; so that observations on the spots alone cannot tell us the rapidity of the revolution of the sun's entire mass.

It has also been noticed that the number of these spots visible at one time does not remain the same from year to year, and, in fact, that about every ten years there is an epoch at which they are especially abundant. General Sabine has pointed out that these periods of frequency of sunspots are coincident with the periods of greatest magnetic disturbance on our own globe. Accordingly, we see that there exists a distinct and close connection between variations in the appearance of the sun, and changes in the physical constitution of our earth.

The interesting question now arises: what are the sunspots? and what is their cause? The very careful investigations of science have thrown much light upon this interesting subject. One of the most remarkable features of the spots is, that their central portion is darker than the edge; and accordingly, nearly a century ago, it was suggested that they were pits in an envelope which surrounded the sun. The results of later experiments seem to confirm this idea. They further go to show that the faculæ, or bright patches, are really of the nature of luminous clouds, placed, relatively to the sun, above the level of the spots.



THE SUN AND ITS REMARKABLE SPOTS.

These faculæ are generally seen behind the spot, a position which they would neces-

sarily assume if they were thrown up to a greater distance from his centre, and would move more slowly. The same observations have shown that spots are produced below the level of the sun's photosphere, while the faculæ are suspended in that medium. If



A TYPICAL SUN-SPOT.

this be admitted, it seems to follow that the two phenomena are effects of a vertical circulation in the gaseous matter surrounding the sun, the faculæ being produced when a portion somewhat denser than the medium in which it is suspended is raised into or above the photosphere, while spots are observed when such a mass is below the photospheric stratum. In fact, one of our diligent sun observers has seen a faculæ, apparently in the act of sinking, lose its brightness and gradually pass into a spot, its form remaining unchanged during the process.

There is a shorter period of twenty months' duration observable in the recurrence of spots, and this coincides with the periods of recurrence of the same relative position of Venus as regards the sun and the earth. The same is true of Jupiter.

Brotherhood of Worlds.

These discoveries are of the greatest interest, as they show us how intimately all the bodies of our solar system are related to each other, and how the slightest change in any one of them exerts a definite influence on the condition of the entire system, despite their great magnitude and distance from each other.

Let us see then in what the spots of the sun consist. Generally, this is the aspect which they present to us in the field of the telescope, as seen in the accompanying engraving.

Two very distinct portions are noticed; at the centre a well-defined black region. Around it a region not so black or grayish compared with the surface of the sun which surrounds it. The central part has received the name of "umbra;" sometimes at the centre of this part is noticed a more intense dark spot, which is called "the nucleus."

The exterior region of the spot has received the name of "penumbra." When it is stated that the centre of the spot is black, this expression must be understood as relative to the general surface of the sun; for this centre, however dark it may appear by contrast, has been found of a light equal to two thousand times that of the full moon.

Enormous Gulfs.

We may be led to the belief that these spots, generally invisible to the naked eye, are insignificant movements carried on on the sun's surface, and of small extent. It is not so. They are daily and very important phenomena. Some of them have been known to measure 80,000 miles, that is to say, they are ten times larger than the earth. Our globe falling into most of them would be lost as in a well. Besides being of this size, they are also the seat of various actions and prodigious phenomena.

They are not formed suddenly as a whole, but increase to the limit they attain, and afterwards diminish. Some only last a few weeks, others months. Now, the movements with which they are animated, either for their increase or diminution, or in their internal action, are sometimes of unheard-of rapidity. Lately, astronomers have followed a dazzling meteor passing throuph a group of spots with a velocity of eight thousand miles per minute. In other parts, they have watched circular whirlwinds, dragging into their commotion large spots like the earth, and swallowing them up in abysses with fearful velocity.

Sometimes are seen the crests of stormy waves extending over parts of the penumbra, and rising on the white surface of the sun as a still whiter and brighter substance, doubtless projected in their ebullition by interior forces. There have, besides, been seen immense bridges of fiery substances cast suddenly over a black spot, crossing it from one end to the other, like an arch of luminous striæ, which sometimes is dissipated, and falls down into the abysses of lower whirlpools.

This body, which each day pours out over our heads such a pure and calm light, is the seat of powerful actions, and prodigious movements, of which our tempests, hurricanes and waterspouts give us but a slight idea; for these gigantic disturbances are not performed, as here, in an atmosphere of a few miles thickness and over a few miles area, but in proportions as vast as its volume. One of the first results of the observation of solar spots was to discover that the sun turns on its axis in about twenty-five of our days.

Rapid Movement of Sun-spots.

Indeed, if we watch for several consecutive days any of the spots visible on the solar surface, or a group of spots, or even the whole sun, we shall not be long in remarking that the spots are all animated with the same movement from one edge to the other of the solar disk. If, for instance, we begin to follow a spot from its appearance at the eastern edge, we observe that it advances slowly towards the middle of the body, which it reaches about seven days after its appearance; then it passes it, and continues its course towards the west, and seven days afterward it reaches the edge and disappears.

After a period of fourteen days, employed in traveling over the opposite hemisphere, it reappears at the same place, and follows the path previously pointed out. These observations evidently show that the sun turns on an axis. This rotation of the sun shows its spots in the following manner: If the period of the reappearance of the spots is from

twenty-five to twenty-eight days, this does not refute the number of twenty-five days before mentioned.

The difference proceeds from the earth not remaining immovable in space, but turning round the sun. Now, in its translatory movement round the sun, the earth advancing in the direction of its rotation, sees the spots two days and a half after they have disappeared at the point where the earth was at the commencement of the observation.

The Sun's Eternal Day.

This rotary movement takes place from west to east, like that of the earth and all planets of the system. Thus, by telescopic examination, this body declared fixed and incorruptible in antiquity, is stripped of its two distinctive qualities. The diurnal rotation of the sun is twenty-five times longer than that of the earth; but it differs essentially in its immediate consequences, because it does not produce on the surface the alternate day and night, which we derive from this movement. It cannot, then, be stated that this is the length of the solar day, for it is not the sign of a succession of light and darkness: the sun's day does not go out, and the twilight of evening does not pale it. This world lives in a permanent light.

It neither knows our seasons nor years, and the elements of our calendar cannot be applied to its astronomical *rôle*. It seems that the rapid succession of things which constitute our time, and the changing series of phenomena which we experience, do not fall to his lot; continuance and endless duration are his characteristics; and he is free from counting for his individual personal life the successive ages which, on our globe, measure life and overwhelm it with their number.

The size of the sun exceeds the degree of our habitual measurements too much for us to hope to give a sufficient idea of it. In the matter of volumes, as in that of distances and times, the numbers too far surpass our ordinary conceptions to appeal to our minds, and every care that we take to represent them to ourselves remains almost sterile. Nevertheless, a comparison will be able to inspire at least a nearer idea of the size to which we refer.

If we placed the terrestrial globe in the centre of the solar globe, like a kernel in the middle of a fruit, the distance of the moon would be included in the interior of the solar body; the moon itself would be absorbed in it, and beyond the moon to the surface of the sun, following the same radius, we should still have to traverse a distance of 200,000 miles. From the earth to the sun are reckoned 91,000,000 miles. It is on account of this great distance that this immense body only appears to measure a foot in diameter; and this explains why the ancients, and Epicurus in particular, did not believe it larger than that measure.

How to Ascertain the Distance.

This distance equally explains why it does not appear to us larger than the moon, which is only 240,000 miles away. From this it may reasonably be asked, how this distance from the sun to the earth could possibly be determined. The method is too complicated for us to explain it here in detail; but an idea may be given of it without exceeding the limits of this chapter.

Between the sun and the earth there are two planets, Mercury and Venus: the latter has rendered the greatest service in the study of the distance, which separates us from the sun. As its orbit (the circumference which it describes round the central body) is nearly on the same plane as the earth's orbit, it

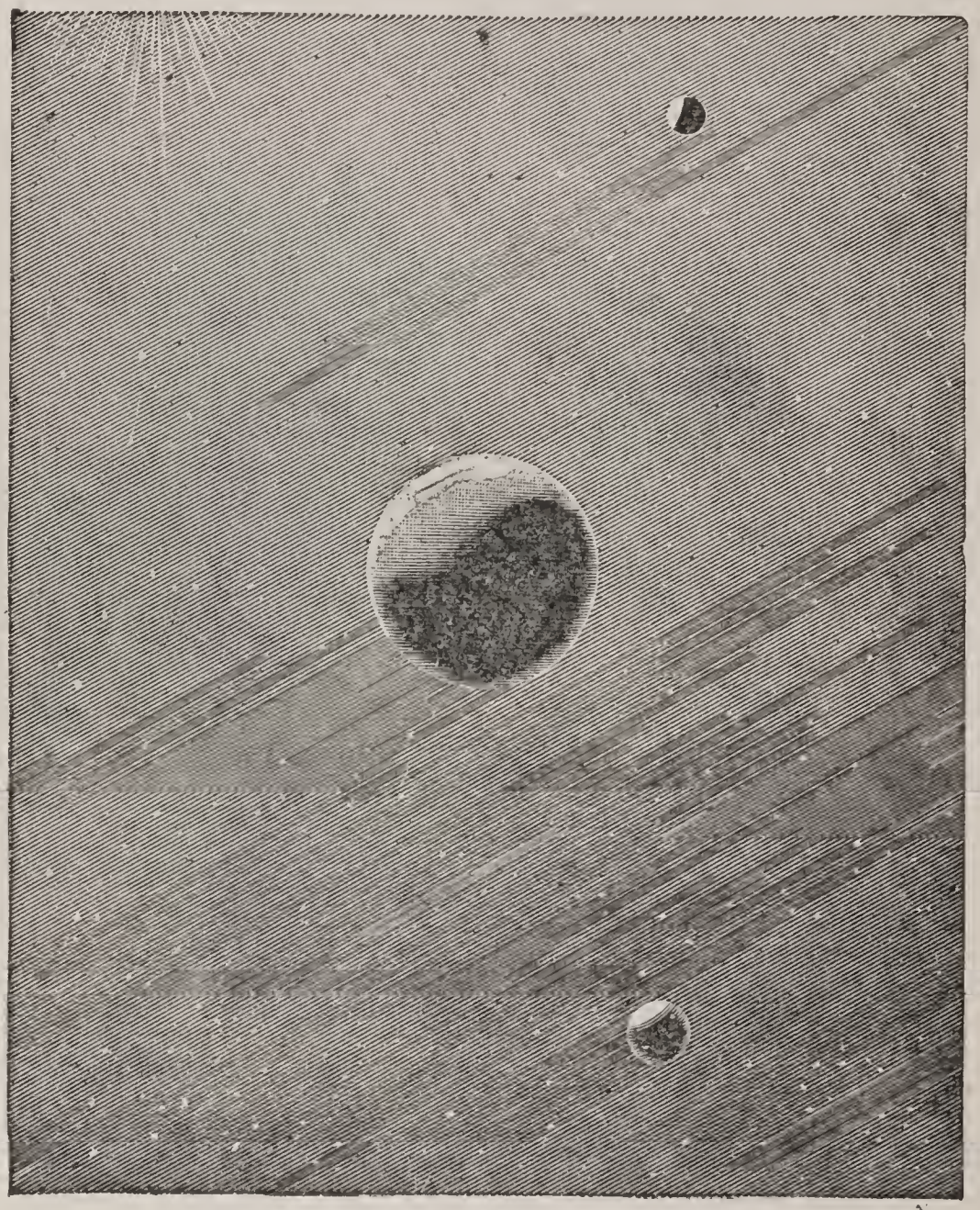
happens from time to time that it passes between the sun and ourselves, and appears like a black spot crossing the luminous disk. This passage takes place at the singular intervals of eight years, 113½ years—8 years, 113½ years + 8 years.

At these valuable periods, astronomers of all countries forget their nationality, and listening to each other like brothers, place themselves so as to observe the passage of Venus in different countries. Two observers situated in the stations most distant from each other, note the two points where the planet, seen from each of their stations, seems to be projected at the same moment on the solar disk. This measure gives them the angle formed by two lines starting from their stations, and crossing each other on Venus, and passing on to the sun. The measure of this angle, gives what is named the parallax of the sun.

Waiting Eight Years.

At the transit of Venus, in 1761, a French astronomer, Le Gentil—his name should have preserved him from such disappointments on the part of Venus—was curiously requited for his love of science and his disinterestedness. Sent to India by the Académie des Sciences, he embarked with arms and baggage to observe the passage of the planet at Pondicherry. His great activity and ardor could not conquer the chances of the sea voyage; he landed a few days after the phenomenon had taken place. The obstacles irritated him and increased his courage. He formed the heroic resolution of remaining for eight years in the midst of that unknown country, in order to compensate himself for his lost observation; he waited for the passage of 1769, and then made all desired arrangements to obtain a perfect observation.

The year and the day at length arrived! The sky was clear and no obstacle hindered his long resolution from at last receiving its reward. But, alas! exactly at the moment when the black spot was about to enter on the solar disk, a small cloud formed in the atmosphere and remained before the sun until the moment when Venus left the disk, putting an end to the possibility of all observation. The astronomer again took the voyage to France with a stormy sea, which brought his days to a close.



THE EARTH FLOATING IN SPACE.

The last transit of Venus was in 1882, and there will not be another until June, 2004.

From considerations based on the magnetic action of the sun, we may be led to

believe that its light is of the same nature as the electric light, only incomparably more powerful, seeing that the elements which we have at command are infinitely inferior to those commanded by nature. However bright our electric foci may be, however dazzling their light, the whiteness of which astonishes us, when it is projected on the solar disk, the electric light has the appearance of a black spot.

Inconceivable Heat.

The intensity of solar heat is not less difficult to conceive; the most intense of our furnaces, which rise to the temperature of white heat, does not give us a faint idea of it. However, the following comparisons will indicate its value. If we represent the sun under the form of an enormous globe built up of a million four hundred thousand terrestrial globes, and covered entirely with a stratum of coal fourteen miles thick, the heat which it pours out annually in space is equal to that which would be furnished by this stratum of flaming coal. This solar heat would also be capable of melting in one second a column of ice which would measure 1590 square miles at its base, and 192,000 miles high.

It is curious to inquire how much this gigantic body weighs. When astronomers place the sun in one of the pans of the immense scales with which they determine the weight of the stars, it is necessary for them to put in the other one, 350,000 terrestrial globes like our own to restore equilibrium.

Many of the chemical effects of the sun's light are, and long have been, familiar. Linen and cotton cloth exposed to it, for a length of time, as is well known, will be bleached; and fabrics dyed of certain colors will be faded, or changed into a different shade. Yellow wax laid beneath the solar rays will be turned white; and the colorless horn silver in a few minutes changed into a violet tint. And so of many other substances.

If a piece of paper, or a finger, be dipped in lunar caustic, and then be exposed to the sun, it will quickly turn black. If initial letters or names be written on linen with what is called indelible ink, they will be at first quite pale, but by a short exposure to the sunlight they turn dark. If a sheet of paper be plunged into a solution of common salt, then dried, and again be dipped into a solution of silver, it becomes so sensitive to the action of the sunrays, that if ferns and leaves such as those represented in Fig. 1, be placed upon it, and then exposed to the summer's sun, the uncovered part of the paper will turn black, while that beneath the ferns and leaves will remain white, presenting an exact impress of the whole group, as in Fig. 2.

Pictures Made by the Sun.

Nothing can give a more beautiful picture of them; the light works through the slender leaves, but not through the thicker and more compact stems, and thus copies all, even to the minutest veins. This process has been turned to important practical purposes; it has been of great service, for example, in military operations, where it was necessary to make quickly a copy of some map of which there was only one impression. If a duplicate had to be made by hand, it would require several days to accomplish it; nor would it then have been as correct as that printed by the sun in the above manner.

It is by the chemical action of the sun, as is well known, that the photographer brings forth his marvelous productions—productions which are not only of pleasing personal interest, but of the greatest practical value in art, science, and literature. By the simple action of the sunrays upon certain

substances overspreading the surface of metallic or paper tablets, he can obtain an accurate likeness of any person, place, or thing he may desire. In this way he is enabled to preserve for us the lineaments of those who have benefited their race by their learning, their skill or their bravery.

By the agency of the very rays which illumine the countenance and reveal the brilliancy of the laughing eye and the charm of the roseate cheek, he can at once secure for us a lifelike picture of the form and features we most admire and love. In the same manner he can copy the outlines and details of natural scenery with perfect fidelity. In his picture will be found every undulation of the landscape, every projecting rock, every sinuous stream, each spreading tree, each grazing ox, the peasant's home, the village spire, together with every other object and feature in the scene—these, all these, he can faithfully transfer to his plate, in all their varied and delicate shades, by the agency of the sunbeams which illuminate the whole.

The chemistry of the solar rays, in our day, has become a most important auxiliary to nearly every branch of human study or investigation. By its means the traveler is enabled to bring home accurate representations of the scenery, inhabitants, and productions he has witnessed in foreign climes; the geologist, to secure unerring delineations of the marvellous fossils of the flora and fauna he has discovered in the deep strata of the earth; the astronomer, to present the transient appearances of the eclipses he has observed in the heavens; the meteorologist, to furnish a correct registry of his barometer and thermometer every hour.





Fig. 1. WREATHS COPIED BY THE SUN. Fig. 2.

By its aid the antiquarian is able to obtain a fac-simile of the ruined temples, broken statuary, and obscured inscriptions which he has found on the fields of ancient civilization and power; the botanist, to copy with nature's exactness the forms and parts of plants, the stamens, and corolla, and pistils, and pollen of flowers; and the anatomist, to exhibit the various organs and functions of the body, both in their normal and abnormal conditions.

As nothing is more general in its application, so nothing is more perfect and ad-

mirable in its execution, than the sunbeam. No object is too great, and none too minute for it to depict. It can give us large pictures, with every detail perfect and in its right proportion, of the minutest objects, such as insects and animalcula; and it can furnish us with microscopic pictures, equally correct, of objects huge or vast. This is achieved by the intervention of lenses that magnify or diminish the image.

Microscopic photography is of great importance in relation to anatomic preparations, which quickly change and become decomposed; it is also of very essential help in the study of fixed and permanent bodies. Jewelry, and even toys are sometimes made, containing minute photographs beneath small magnifying glasses. When these are held before the eye, small transparent images, some of them portraits, some statues, and others, writings, come into view in admirable perfection. Such things, however, serve rather for amusement than use.

Microscopic Photography.

But there are cases where microscopic photography may prove of no little value and importance. It has been suggested that in this way the contents of ponderous volumes might be concentrated within a few square inches, and the books of a whole library be reduced within the capacity of a single drawer. Though nothing of this sort, as far as the author is aware, has thus far been done, yet the process has been employed for other ends under most interesting circumstances.

Professor Hermann Vogel relates that during the seige of Paris, in 1870, the blockaded city held communication with the world outside by means of balloons and carrier pigeons. The first mode of communication was almost engrossed for political objects; the second only admitted the transmission of very minute writing. Letters, however condensed, could scarcely have been sent more than two or three at a time by a pigeon. In this case, microscopic photography presented a valuable means of concentrating many pages on a collodion film of only one square inch, and of expediting more than a dozen of such almost imponderable films packed in one quill.

What the Sunbeam Can Do.

Dagrand, at Paris, who first prepared microscopic photographs, also set going the system of these pigeon dispatches. All the correspondence which had to be diminished was first set up in type, and printed together on a folio page. A microscopic photograph was made of this folio page, contained in about the space of 1½ square inches. This collodion film, with the image upon it, was then glazed over by pouring leather collodion over it; that is, collodion containing a solution of glycerine. This glucose collodion easily dries, separates from the picture, and forms a transparent film; a membrane of this kind could contain as many as fifteen hundred despatches.

At the place of arrival these membranes were unrolled, and then enlarged by the help of a magic lantern; a number of writers thereupon set to work to copy the enlarged despatches, and ultimately forwarded them to their respective addresses. Thus Paris corresponded, by the aid of photography, for six months with the world without, and even poor persons were able to let their relatives know that they still lived.

Another marvelous fact pertaining to the chemistry of the solar ray is, the rapidity with which it produces its effects upon certain substances. A new negative process has lately been discovered; it consists in the

use of a gelatine emulsion of silver bromide for the sensitive surface. With a plate thus prepared, a photograph may now be taken in one second of time which it formerly took thirty seconds to secure; and a plate can be prepared which needs an exposure of only one-sixtieth of a second, when a view is fairly lighted, to secure a soft and harmonious negative.

Thus it appears that the solar rays are capable of instantaneous chemical action, and of producing for us a perfect picture of a man in full activity, or of an object in rapid motion. The likeness of an orator may be taken at the moment of his highest pitch of eloquence, giving not only his attitude and gesticulation, but the very expression of his features. A squadron of cavalry can be pictured as they advance with rushing speed to the deadly charge, each man, each horse appearing a distinct figure in the scene.

Nay, a view has been taken in which the shadow and reflections of a swallow passing in the air over a pond were perfectly represented. How wonderful the workings of the laws of nature! how closely related all its parts! how admirably constituted every ray of the sun to move every atom to accomplish the purposes of Him who worketh all in all.

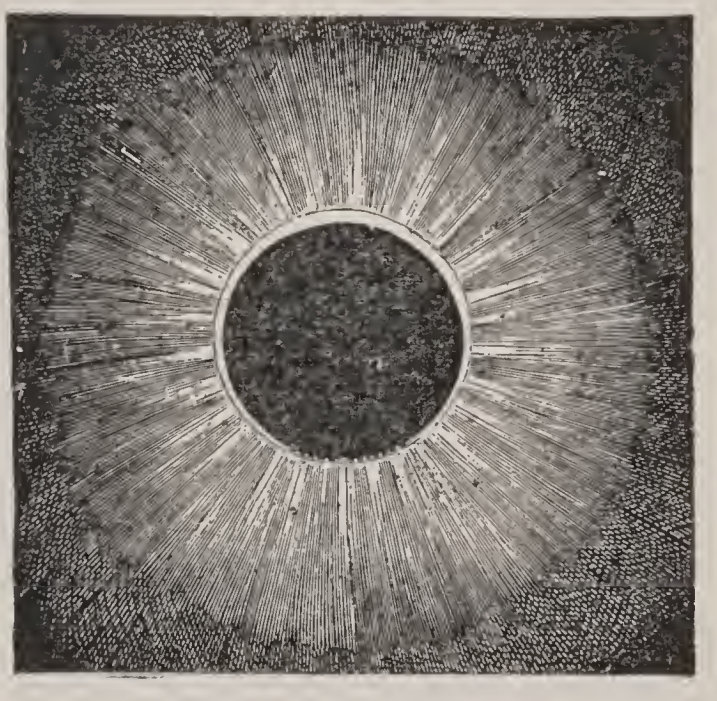
Eclipse of the Sun.

The total eclipse occurs when the moon is near to the earth, and when her distance from us is such that her apparent diameter is sufficient to cover the entire disk of the sun. This is an event of great interest to the astronomer, both on account of its short duration and rare occurrence.

The longest time an eclipse of the sun can be total is seven minutes; but often it does not exceed three or four minutes.

And it takes place at any one locality only at distant intervals; for instance, at London, prior to the total eclipse of 1715, no such phenomenon had been visible for a period of 575 years.

Among all the evolutions of the creation, visible to us, no occurrence is more striking or impressive than this. "A total eclipse of the sun," says Lockyer, "is at once one of the grandest and most awe-inspiring sights it is possible for man to witness. As the eclipse advances, but before the disk is wholly obscured, the sky grows of a dusky livid, or purple, or



THE SUN ECLIPSED.

yellow crimson color, which gradually gets darker and darker, and the color appears to run over large portions of the sky, irrespective of the clouds. The sea turns lurid red. This singular coloring and darkening of the landscape is quite unlike the approach of night, and gives rise to strange feelings of sadness.

"The moon's shadow sweeps across the surface of the earth, and is even seen in the air; the rapidity of its motion and its intenseness produce a feeling that something material is rushing over the earth at a speed perfectly frightful. All sense of distance is lost; the faces of men assume a livid hue,

flowers close, fowls hasten to roost, cocks crow, birds flutter to the ground in fright, dogs whine, sheep collect together as if apprehending danger, horses and oxen lie down, obstinately resisting the whip and the goad; in a word, the whole animal world seems frightened out of its usual propriety and all things wear the garb of terror."

The Brilliant Corona

CELESTIAL phenomena, also, attend a total eclipse, still more grand and imposing. A few seconds before the commencement of the total obscuration, the stars burst out, and surrounding the dark moon on all sides is seen a glorious halo, commonly of a silvery white light, which is called the corona. This radiates and extends beyond the moon, to a distance equal to her apparent diameter, and in some eclipses is observed to reach to a much greater distance.

This luminous appendage is supposed to be the sun's atmosphere, which is not seen when the sun itself is visible, owing to its overpowering splendor. General Myer gives the following description of the corona, as observed by him from the summit of White Top Mountain, Virginia, 5530 feet above the level of the sea, this elevated station being chosen in order to escape the smoke and haze which generally prevail in lower regions:

"The eclipse presented, during the total obscurations, a vision magnificent beyond description. As a centre stood the full and intensely black disk of the moon, surrounded by the aureola of a soft, bright light, through which shot out, as if from the circumference of the moon, straight, massive, silvery rays, seeming distinct and separate from each other, to a distance of two or three diameters of the lunar disk, the whole spectacle showing as upon a background of diffused rose-colored light.

A Gorgeous Spectacle.

"This light was most intense, and extended farthest, at about the centre of the lower limb, the position of the southern prominence. The silvery rays were longest and most prominent at four points of the circumference, two upon the upper and two upon the lower portion, apparently equidistant from each other, giving the spectacle a quadrilateral shape."

Great changes in the solar prominences, as a rule, take place only very slowly, or quite imperceptibly. In some cases, however, the change in the form of a prominence is so extraordinary, and occurs with such rapidity, that it can only be ascribed to extremely violent agitations in the upper portions of the solar atmosphere, compared with which the cyclonic storms occasionally agitating the

earth's atmosphere, sink into insignificance.

Professor Respighi is of the opinion that the solar prominences are of an eruptive origin and of a gaseous nature, and that electric action in some form is concerned in producing these eruptions. He observed some prominences that exceeded three minutes, or ten times the earth's diameter, in height; and one prominence that was not less than twenty times the earth's diameter, or 160,000 miles in altitude. He also noticed that the formation of a prominence is usually preceded by the appearance of a rectilinear jet, either vertical or oblique, and very bright and well defined.

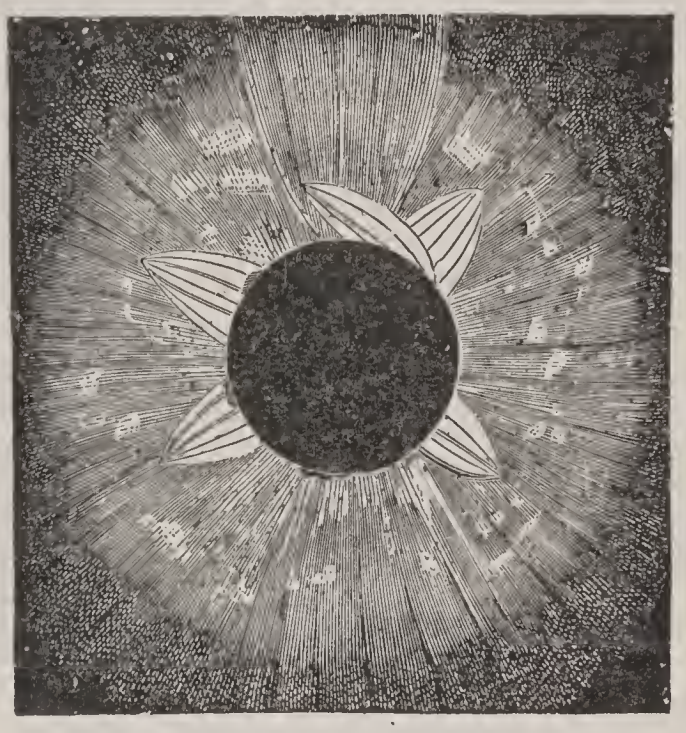
Wonderful Eruptions.

This jet rising to a great height, is seen to bend back again, falling toward the sun like the jets of our fountains, and presently the sinking matter is observed to assume the shape of gigantic trees, more or less rich in branches and foliage. Gradually the whole sinks down upon the sun, sometimes forming isolated clouds before reaching the solar surface. It is in the upper portions of such prominences that the most remarkable and rapid transformations are witnessed; but a great difference is observed in the rate with which prominences change in figure.

Their duration, too, is very variable. Some develop and disappear in a few minutes, while others remain visible for several days. He considers that the sharply defined bases of the eruptive jets prove that the eruption takes place through some compact substance, forming a species of solar crust. He also holds that the enormous velocity with which these gaseous masses rush through the solar atmosphere implies that the latter is of exceeding tenuity.

Professor Young, of Dartmouth College, by means of an instrument called "telespectroscope," witnessed the most remarkable outburst from the sun ever yet seen by man. "On the 7th of September, 1871, between 12.30 and 2 P. M.," he says, "there occurred an outburst of solar energy remarkable for its sudden violence. Just at noon I had been examining with the telespectroscope an enormous protuberance of hydrogen close on the eastern limb of the sun. It had remained with very little change since the preceding noon—a long, low, quiet-looking cloud, not very dense or brilliant, nor in any way remarkable except for its size.

"It was made up mostly of filaments



REMARKABLE CORONA.

nearly horizontal, and floated above the chromatosphere with its lower surface at a height of some 15,000 miles, but was connected with it, as is usually the case, by three or four vertical columns brighter and more active than the rest. Lockyer compares such masses to a banyan grove. It was about 100,000 miles long by 54,000 high.

"At 12.30, when I was called away for a few minutes, there was no indication of what was about to happen, except that one of the connecting stems at the southern extremity of the cloud had grown considerably brighter, and was curiously bent to one side; and

near the base of another at the northern end a little brilliant lump had developed itself, shaped much like a summer thunder-head. The annexed figure represents the prominence at this time, *a* being the thunder-head.

"What was my surprise, then, on returning in less than half an hour, to find that in the meantime the whole thing had been literally blown to shreds by some inconceivable up-rush from beneath. In place of the quiet cloud I had left, the air, if I may use the expression, was filled with flying *débris*—a mass of detached vertical fusiform filaments, brighter and closer together where the pillars had formerly stood, and rapidly ascending.

"When I first looked, some of them had



BANYAN GROVE ON THE SUN.

already reached a height of nearly 100,000 miles, and while I watched them they rose with a motion almost perceptible to the eye, until in ten minutes the uppermost were more than 200,000 miles above the solar surface. This was ascertained by careful measurement. The velocity of ascent also, 166 miles per second, is considerably greater than anything hitherto recorded.

"A general idea of its appearance when the filaments attained their greatest elevation may be obtained from the accompanying cut (Fig. 1). As the filaments rose they gradually faded away like a dissolving cloud, and at 1.15 only a few filmy wisps, with some brighter streamers low down near the chromatosphere, remained to mark the place.

"But in the meanwhile the little thunder-head, before alluded to, had grown and developed wonderfully into a mass of rolling and everchanging flame, to speak according to appearance. First it was crowded down, as it were, along the solar surface (Fig. 3, *a*); later it rose almost pyramidally 50,000 miles in height; then its summit was drawn out into long filaments and threads which were most curiously rolled backwards and downwards, like the volutes of an Ionic capital (Fig. 2); and finally it faded away, and by 2.30 had vanished like the other. The accompanying cuts show it in its full development; the former having been sketched at 1.40, and the latter at 1.55.

Grand Burst of Flame.

The whole phenomenon suggested most forcibly the idea of an explosion under the great prominence, acting mainly upwards, but also in all directions outwards, and then, after an interval, followed by a corresponding in-rush. The same afternoon a portion of the chromatosphere on the western limb of the sun was for several hours in a state of unusual brilliancy and excitement.

Such are some of the marvelous phenomena made known to us by astronomical science. We can say with Byron in his brilliant apostrophe:

Glorious orb! the idol
Of early nature and the vigorous race
Of undiseased mankind, the giants' sons
Of the embrace of angels with a sex
More beautiful than they which did draw down
The erring spirits who can ne'er return,—
Most glorious orb! that wert a worship ere
The mystery of thy making was revealed!
Thou earliest minister of the Almighty,
Which gladdened, on their mountain-tops, the hearts
Of the Chaldean shepherds till they poured
Themselves in orisons? Thou material God!
And representative of the Unknown—
Who chose thee for His shadow! Thou chief star,
Centre of many stars! which make'st our earth

Endurable, and temperest the hues
And hearts of all who walk within thy rays!
Sire of the seasons! Monarch of the climes,
And those who dwell in them! for near or far,
Our inborn spirits have a tint of thee,
Even as our outward aspects: thou dost rise,
And shine, and set in glory.

The formation of visible vapors, and their aggregation in masses, take place generally in high regions of the atmosphere under the action of currents, in consequence of a decrease of temperature and a due supply of aqueous elastic vapor being present in those parts where clouds arise. It is easy to perceive that these two conditions, necessary to the production of cloud-land, may be fulfilled in one stratum of the atmosphere and not in another; and hence the frequent diversity in the appearance of the sky, the clear blue fields and patches of ether alternating with visible vaporous structures.

The clouds are supposed to consist of minute globules of water filled with air; but there is great difficulty, even with the aid of this view of their structure, in explaining their suspension aloft, for the globules must be specifically heavier than the air by which they are upborne. The theory of ascending currents of heated air has been proposed by Lussac to account for their position; and the retention of solar heat in the clouds themselves, buoying them up and causing them to float, by Fresnel.

The clouds float at different elevations, but the higher we ascend the drier the atmosphere is found, and the less loaded with vapors. We shall not err much, says Leslie, if we estimate the position of extreme humidity at the height of two miles at the pole, and four miles and a half under the equator, or a mile and a half beyond the limit of congelation. Dalton asserts that small, fleecy patches of cloud are frequently from three to five miles in height, and such have been observed sailing above the most elevated peaks of the Andes, which rise twenty-five thousand feet above the level of the sea; but other authorities claim for some visible clouds a still greater elevation. The height varies at different seasons of the

Fig. 1.

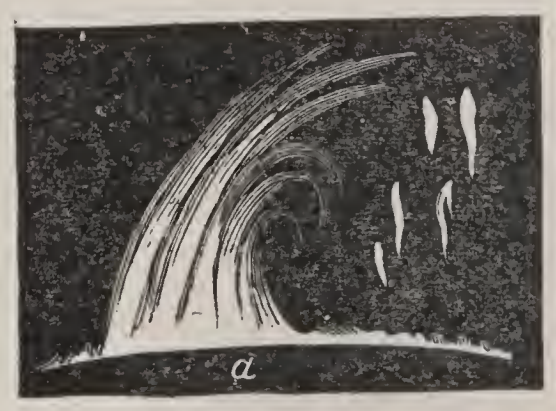
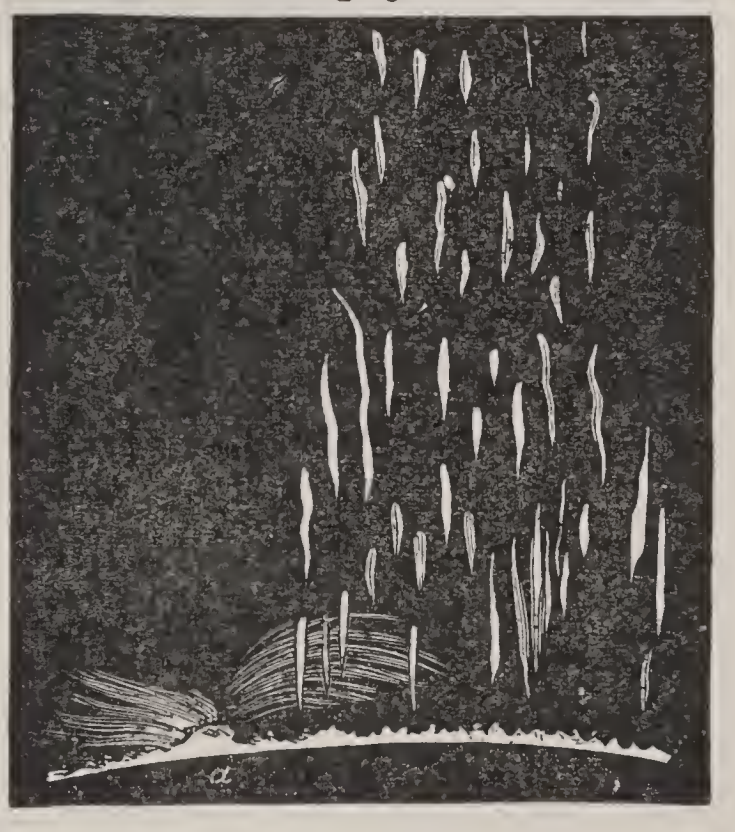


Fig. 2.



Fig. 3.



EXPLOSIVE PHENOMENA IN THE SUN.

year, and there is little doubt that it is much more frequently below than above a mile.



STRIKING APPEARANCES OF CLOUD-LAND.

The effect is striking when, from an eminence which commands a view of an extensive plain or valley, we see the gossamer curtain of the night resting upon the surface, gradually rent and torn by the action of the sun's rays, reflecting their golden hue as it disappears. Many of the most felicitous images of poetry are derived from this source, as in Ossian: "The soul of Nathos was sad, like the sun in a day of mist, when his face looks watery and dim;" and again, when two contending factions are silenced by Cathmor: "They sunk from the king on either side, like two columns of morning mist, when the sun rises between them on the glittering rocks."

The stratus is occasionally seen under peculiar and striking circumstances, extending over the surface of a sheet of water, without passing the boundary of its banks. Thus a lake or river will exhibit a white cloud of visible vapor resting upon it, from which the adjacent land is perfectly free. Sir Humphry Davy thus explains this curious phenomenon:

"All persons who have been accustomed to the observation of nature must have frequently witnessed the formation of mists over the beds of rivers and lakes in calm and clear weather after sunset; and whoever has considered these phenomena in relation to the radiation and communication of heat and the nature of vapor, can hardly have failed to discover the true cause of them.

Phenomena of Heat.

"As soon as the sun has disappeared from any part of the globe, the surface begins to lose heat by radiation, and in greater proportions as the sky is clear; but the land and the water are cooled by this operation in a very different manner; the impression of cooling on the land is limited to the surface, and very slowly transmitted to the interior; whereas in water above forty degrees Fahrenheit, as soon as the upper stratum is cooled, whether by radiation or evaporation, it sinks in the mass of fluid, and its place is supplied by water from below; and till the temperature of the whole mass is reduced to nearly forty degrees Fahrenheit, the surface cannot be the coolest part.

"It follows, therefore, that wherever water exists in considerable mass, and has a temperature nearly equal to that of the land, or only a few degrees below it, and above forty degrees Fahrenheit at sunset, its surface during the night, in calm and clear weather, will be warmer than that of the contiguous land; and the air above the land will necessarily be colder than that above the water; and when they both contain their due proportion of aqueous vapor, and the situation of the ground is such as to permit the cold air from the land to mix with the warmer air above the water, mist or fog will be the result."

The atmosphere of our globe is composed mainly of two gases, oxygen and hydrogen, whose combination forms a perfectly transparent medium. In this medium, however, there floats at all times a vast quantity of aqueous vapor, raised daily by the heat of the sun, in the form of steam, from the surface of the sea and of the dry land. The amount of water thus lifted into the air by the process of evaporation is very great, and far exceeds that discharged into the ocean, during the same length of time, by all the rivers of the earth.

How the Sun is Colored.

The aqueous vapor produced in this manner is diffused through the whole body of the atmosphere, and is in a state of perpetual motion and change, being rarefied into an invisible condition, or condensed into mists and clouds, according to the varying degrees of heat or cold to which it is exposed; and in this way it affects, sometimes more and sometimes less, the general transparency of the air, and modifies both the colors and the forms of objects seen through it. And in the present chapter we are to speak of the various aspects which it gives to the solar orb.

The sun, viewed through a vaporous atmosphere, appears in "false colors." When the vapor is dry and rarefied, or in an invisible condition, the air is clear, and the sun is seen in its natural brightness. But if the vapor be slightly condensed, and takes the form of mist, he appears through it as if shorn of his glories, a white orb, upon which the eye can rest without pain or inconvenience; as he descends he grows still more dull; and finally, as he approaches the horizon, he gradually assumes a rosy tint, and at last a deep red color.

These changes are thus explained. Every ray of the sunlight which comes to us has to

pass through the whole thickness of the atmosphere, and the greater the distance it has to travel the greater the portion of it that is absorbed by the vapors in the air. And this distance, as is obvious, increases with the increased declination of the sun.

If we admit the atmosphere to extend vertically to the height of sixty-two miles, a ray of light coming from the sun at the zenith has only these sixty-two miles to pass through in order to reach us. But a ray from the sun on the horizon has to travel through seven hundred and six miles, or more than eleven times the former distance, and that, too, through the densest portion of the atmosphere. In traversing this great distance, the various colors combined in the perfectly white ray, except the red, are, for the most part, absorbed by the slowly condensing vapors along the cooling surface of the earth. Hence the red color in which the sun appears at its setting and rising.

The Sun's Apparent Form.

The sun, viewed through a vaporous atmosphere, often appears, also, in a "false form." Seen on the meridian, through a clear sky, he appears as a perfect circle, which is his true outline. But as seen near the horizon, in certain conditions of the atmosphere, instead of being circular, he appears of an oval form, the upper and lower sides being flattened, and the latter more so than the former. On high mountains, and on plateaux near the seacoast, this flattening of the disk appears very considerable, amounting sometimes to one-fifth the apparent diameter of the sun. This peculiar deformation is caused by the refraction or bending of the rays of light in passing through the vapors of the atmosphere. Sometimes the want of homogeneity in the successive layers of the atmosphere, caused by the unequal admixture of vapors, gives to the sun an apparent form of so irregular a character that he is scarcely recognizable.

Again, the sun, viewed through the atmospheric vapors, in a certain state, appears surrounded by appendages which do not belong to him. When the sky is hazy, and presents a dull, milky appearance, there is frequently to be seen around the sun a colored circle, or halo, and the sun occupying the centre of the circle, as *h h*. The inner edge of the circle is colored red, and is well defined. The sky within the halo is much darker than it is for some distance without.

Magnificent Halos.

Sometimes there may be seen around the sun a second halo or colored circle, as H H. The inner edge of this also is red, and tolerably well defined, while the outer edge is of a pale blue color, and but faintly marked. At rare intervals, a third halo, radius, as H′ H′, has been observed, surrounding the sun. Unlike the other two halos, this one shows scarcely a trace of color.

All these phenomena are produced by the refraction of the sunlight in passing through the minute crystals of frozen vapors floating in the atmosphere; these crystals being of various kinds and having their facets set at different inclinations to one another, refract the various colors of the sunrays at different angles, and thus produce halos of different diameters.

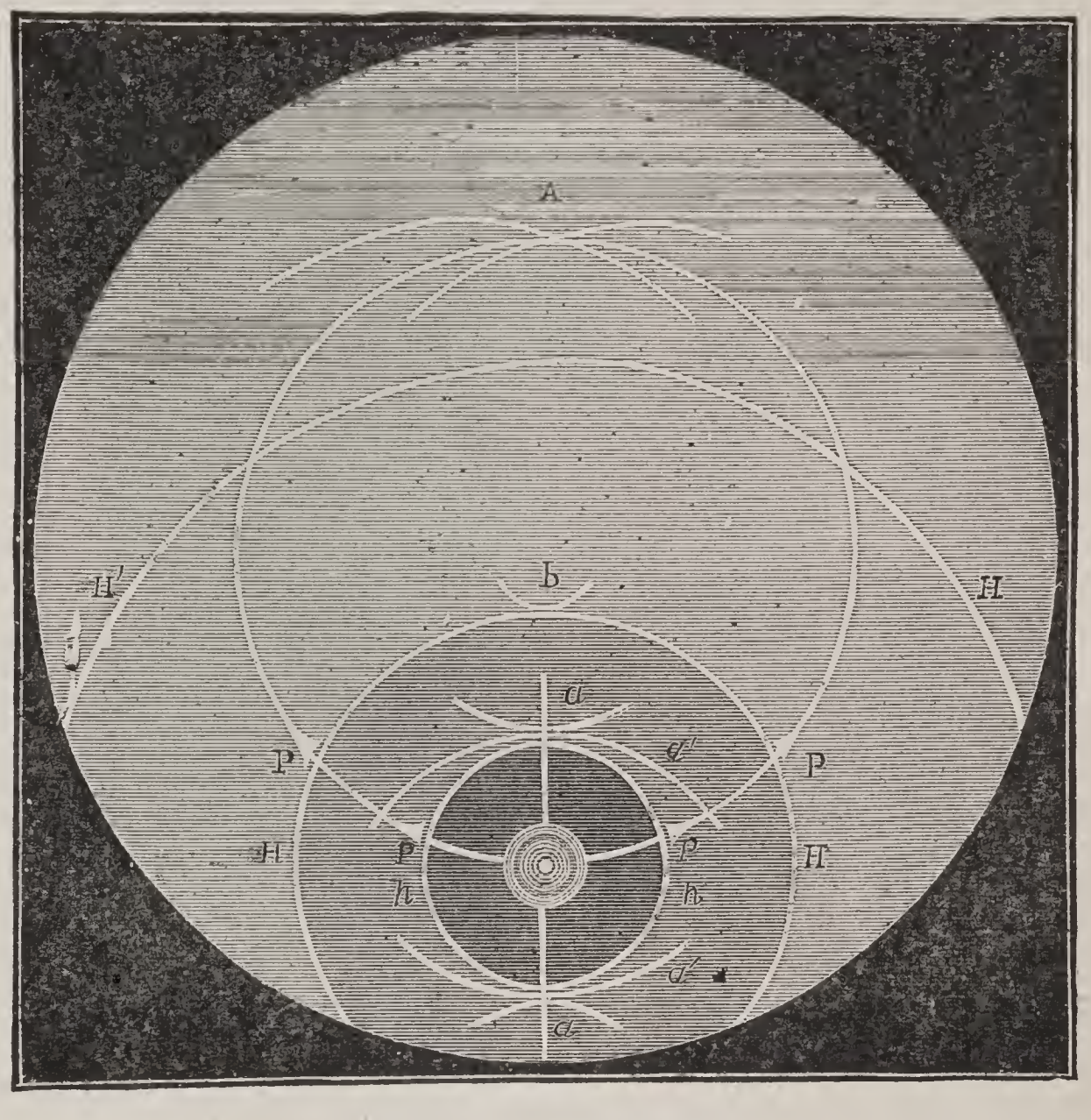
When a halo is formed around the sun, there is often to be seen a white circle passing through the sun, and parallel to the horizon, as represented by A P P. This is called parhelic circle, and is produced like the foregoing by the reflection of the sun's light from ice prisms or snow crystals, whose surfaces have a vertical position. At or near those points where halos cut the parhelic

circle, there is a double cause of light; and here the illumination is sometimes so great as to present the appearance of a mock-sun, and is called parhelion.

The number of these mock-suns, or parhelia, visible at the same time, is variable; sometimes one or two only are to be seen, at other times four or five; on some occasions as many as seven have been observed at once. The mock-suns generally seem about the size of the true sun, but not quite so bright, though occasionally they are said to rival their parent luminary in splendor. These beautiful phenomena appear most commonly in high latitudes, but often occur in the more temperate regions.

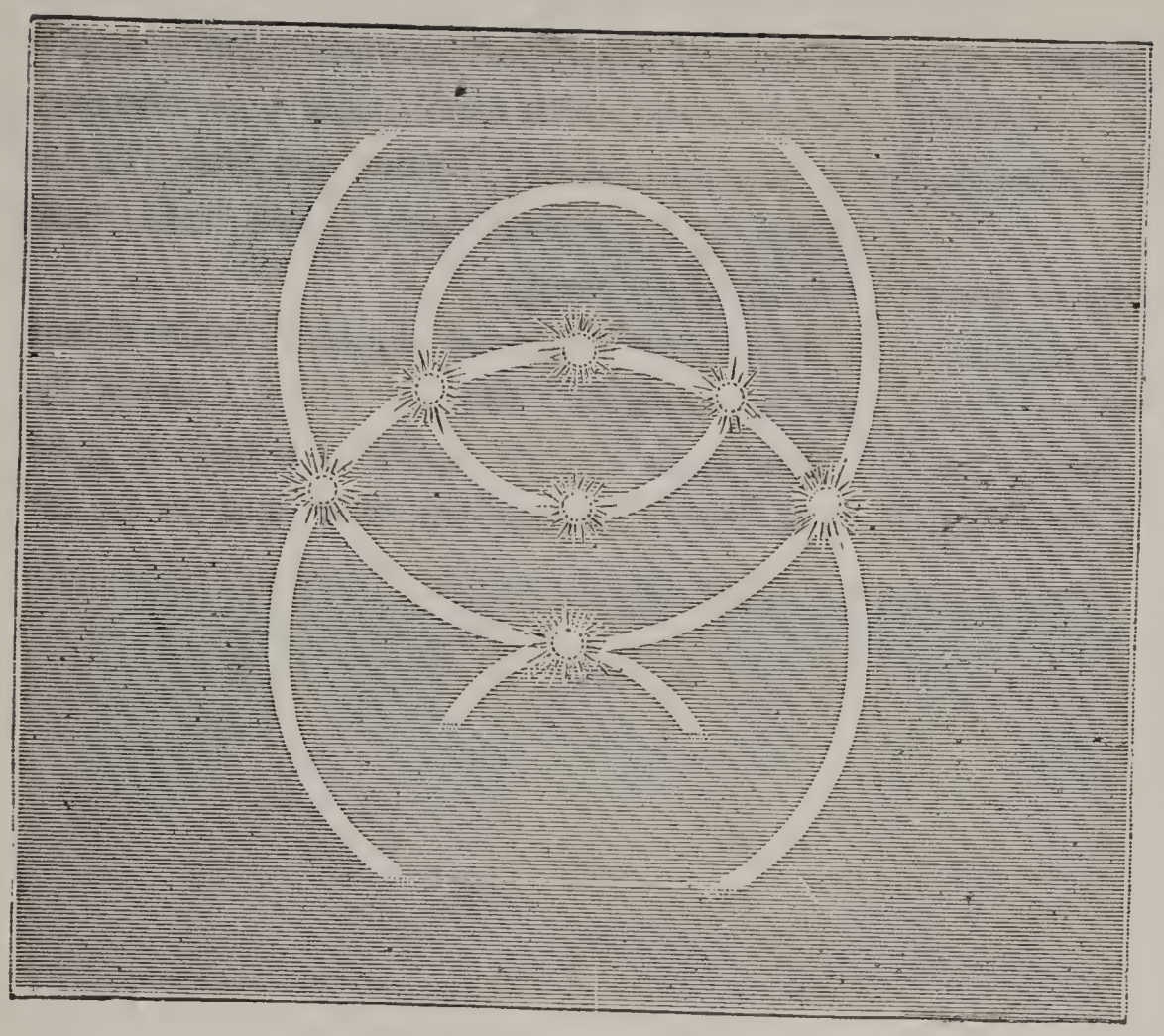
Parhelia have been observed frequently both in ancient and modern times. Aristotle records two appearances of these meteors, and Pliny mentions their occurrence at Rome. A double parhelion, which was noticed before the Christian era, is referred to by St. Augustine. Many others have been observed from different points on the continent. On the 2d of January, 1586, Christopher Rotham saw, at Cassel, before sunrise, an upright column of light of the breadth of the sun's disk. As the sun rose, he was preceded and followed by a parhelion, which appeared in contact with his orb, and continued visible for thirty minutes and then were hidden by a cloud. On the 28th of February, 1551, mock-suns were seen at Antwerp; and on the 17th of March of the same year, a similar phenomenon, with two halos, was witnessed at the same place. Four days after the last named, two parhelia, with three halos, were seen at Magdeberg.

Scheiner witnessed a singular one at Rome, on the 20th of March, 1629. From the zenith as a centre there was seen a great white circle, having the true sun in its circumference; this was intersected by two concentric circles around his disk. Where the outer of these smaller rings cut the zenithal circle, two parhelia appeared, and in the great circle, nearly opposite to these, but separated by a wider arc, two others were visible.



HALOS AND PARHELIA.

Gassendi describes a very remarkable instance of this phenomenon, which was seen in 1630. Around the sun were two concentric

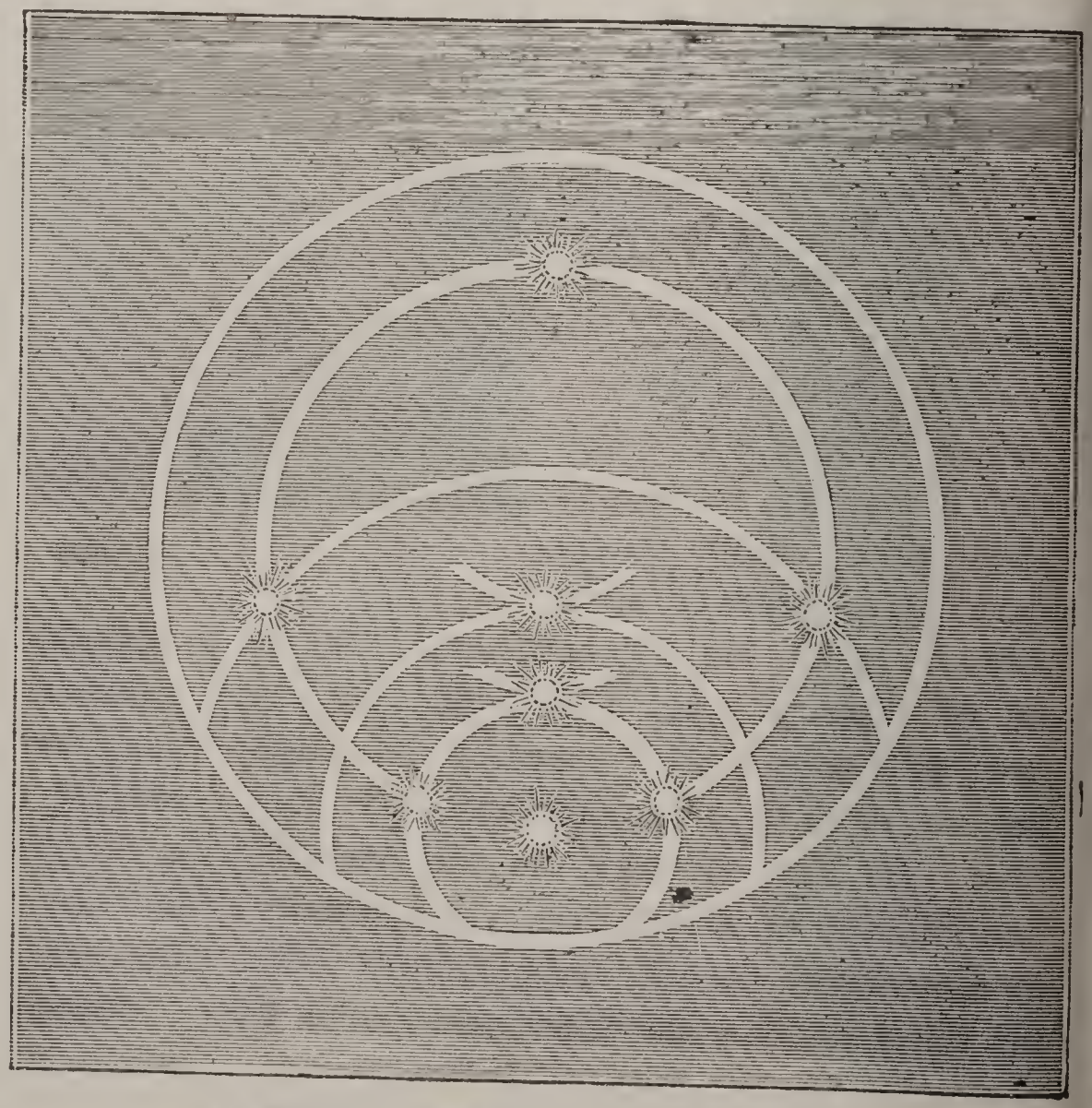


PARHELIA OBSERVED BY GASSENDI.

halos; the larger cut the horizon, and consequently was incomplete; these were colored like the rainbow, excepting that the red was internal. In the direction of the zenith, there was a tangental arc external to these halos; and with the zenith as a centre, a great white circle ran parallel with the horizon, having the true sun in its circumference. At the five intersections of these circles and arcs parhelia appeared, and a sixth was seen in the internal halo between the true sun and the zenith.

One of the finest meteors of this kind on record was seen by Hevelius, at Sedan, on the 20th of February, 1661. "A little before 11 o'clock," he says "the sun being towards the south and the sky very clear, there appeared seven suns together, in several circles, some white and others colored, and these with very long tails waving and pointing from the true sun, together with certain white arches crossing one another. The true sun was about 25° high, and surrounded almost entirely by a circle whose diameter was 45°, and colored like a rainbow with purple, red and yellow, its under limb being scarcely 2½° above the horizon.

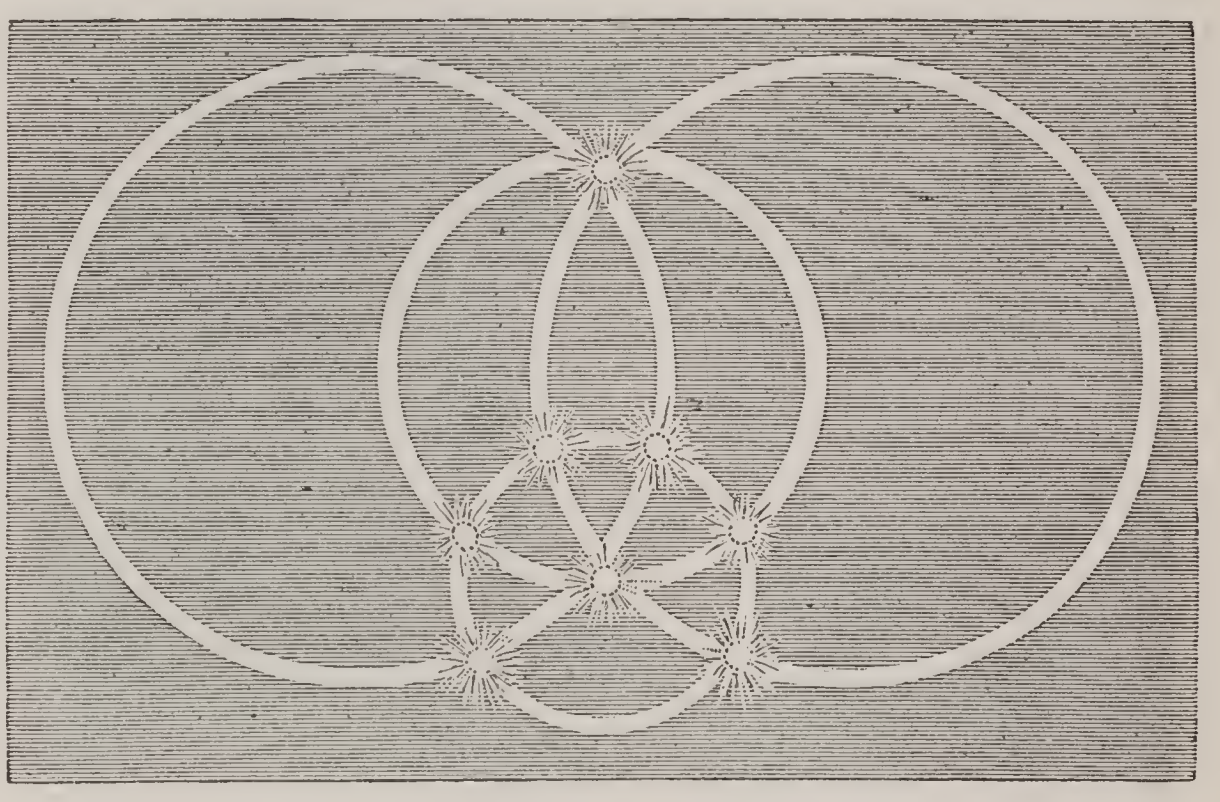
On each side of the sun, towards the west and east, there appeared two mock-suns, colored, especially towards the sun, with very long and splendid tails of a whitish color, terminating in a point. A far greater circle encompassed the sun and the former lesser circle, and extended itself down in the horizon. It was very strongly colored



PARHELIA OBSERVED BY HEVELIUS.

to its upper part, but was somewhat duller and fainter on each side. At the tops of these two circles were two inverted arcs, whose common centre lay in the zenith, and these were very bright and beautifully colored.

In the middle of the lower arc, where it coincided with the circle, there appeared another mock-sun, but its light and colors were dull and faintish. There appeared a circle much bigger than the former, of a uniform and whitish color, parallel to the horizon, which arose, as it were, from the collateral mock-suns, and passed through three other parhelia, of a uniform whitish color like silver. There passed also two other white arches of the greatest circle of the sphere through the eastern and western parhelia, and also through the pole of the ecliptic. They went down to the horizon, crossing the great white circle and obliquely, so as to make a white cross at each parhelion; so that seven suns appeared very plainly at the same time. This phenomenon, with certain changes in the brightness of its several parts, continued visible for an hour and twenty minutes."



PARHELIA OBSERVED IN TENNESSEE.

Such parhelia have been observed at various times and places in North America. Barker describes a curious halo with accompanying mock-suns, which he saw at Fort Gloucester, near Lake Superior. A circle with tangental arc surrounded the sun; about midway between the horizon and zenith, a circle ran parallel to the horizon, having the sun in its circumference; in this horizontal circle there appeared altogether five mock-suns, with this peculiarity, that, directly opposite the true sun in this great circle, a St. Andrew's cross was seen, the upper limbs of which extended higher above, than the lower one descended below, this circle; in the intersection of this cross and the circle, one of the parhelia was placed. A very curious system of circles, with several mock-suns, appeared on the 19th of August, 1825, at Jackson, Tennessee.

An exceedingly curious optical appearance belonging to this class of phenomena, was observed by Mr. Fallows, at the Cape of Good Hope, when the sun's disk was just dipping in the ocean. On either side of the true luminary, and within the breadth of a degree and a half of his disk, four mock-suns appeared on the left, and three on the right. They had the same shape as the true sun, touched the water at the same instant, and all of them disappeared together, shining as bright spots upon the water's edge. This magnificent scene occurred on a delightful evening, when not a cloud was to be seen.

Such are a few of the marvelous appendages which the vapors of the atmosphere sometimes create around the great luminary of the day.

Now, evanescent as is the nature of all these meteoric phenomena at which we have glanced, and irregular as their occurrence may be, yet they are in no sense to be regarded as the result of chance. On the contrary, we see in them the play of exact and beautiful laws. All are produced according to the principles of order established in the beginning, by the One Supreme Lawgiver. In all, brightness and shade prevail in their ordained degrees; and heat and cold produce their designed effects in sea and land and sky. The sunrays in their passage through



BRIGHT HALO IN NORWAY.

visible mists, or viewless vapors, are reflected, refracted, and absorbed, according to uniform rules.

The diameters, distances and intersections of the encircling halos are all measured off after the undeviating principles of geometry. Every tint and shade in their coloring, and every facet and angle in the frozen particles that produce them, display the operations of the unerring laws of optics. Invisible vapors, icy crystals, luminous arches, colored halos, splendid parhelia—all proclaim the observance of law and order. And though the whole magnificent diorama may fade and vanish within the brief space of five minutes, yet, in its production, nothing has been slighted, nothing imperfectly formed, nothing left to be determined by chance.

If a pebble be dropped into the bosom of a still and smooth sheet of water, a circular depression is formed, at the point where it sank, which spreads wider and wider, with uniform velocity. In the meanwhile an elevation has been formed at the point where the pebble, in entering the water, had originally caused a depression; then as this sinks back to its original level it produces a wall-like circular elevation around it, which follows up the preceding circular depression with equal velocity. Whilst the water continues its up-and-down movement at the point struck, fresh wave-rings appear to proceed from this central point, which, owing to their constantly spreading more and more widely, give the illusory appearance of the fluid steaming out on all sides from the middle point.

Now, let us suppose that, instead of one pebble, two are dropped into the water at the same instant, but at a short distance one from the other. We shall have then two systems of circular waves moving and spreading out as before. As these two systems intersect each other, they divide the surface of the water into a regular net-work of small elevations and depressions, as represented in the annexed figure. Yet the one does not destroy or efface the other; at the points where two wave-crests meet, the surface of the water, if the two waves are equal, rises to twice the height, and where two depressions meet, it sinks to double the depth.

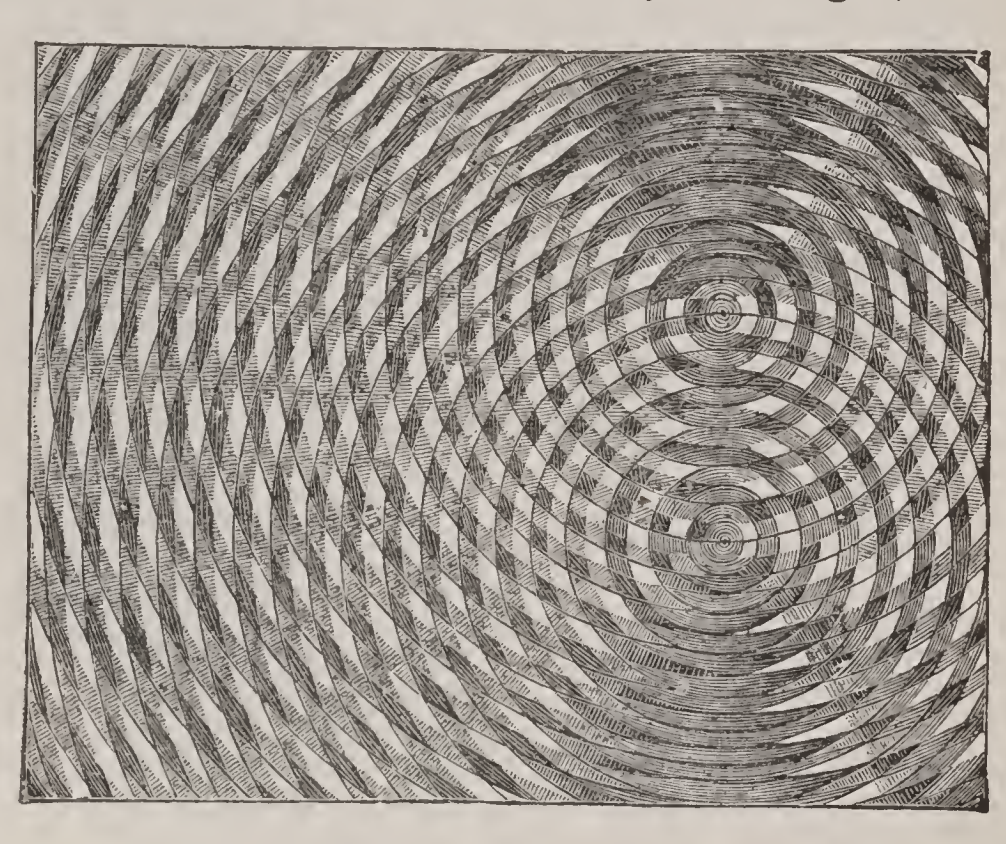
Thus each wave maintains and extends unbroken its circular and moving form, as if it had the entire surface to itself. And if, instead of two, we had three, or in fact, any number of pebbles dropped, the same result would be produced by each of them. In other words, it may be said, that every wave system superimposes itself upon, or adds itself to, a surface already moved by waves, as it would do were it acting alone on that surface at rest. Every wave system forms itself unhindered by those already present, and spreads after it has crossed these, upon the still quiescent surface of the water.

Large and Small Waves.

Once more: suppose that when we have flung a handful of pebbles upon the water, each creating its little system of spreading waves, a succession of large billows or swells be produced by the wind or a passing steamboat, we shall see that even these do not destroy the little waves of the pebbles, but take them on their backs, and having passed, leave them behind with their original forms and motions unaltered. Of all this we may witness a beautiful illustration when large drops of rain begin to fall upon the agitated surface of a lake or river.

Now, similar results, though invisible, are produced in the atmosphere by a blow on a drum or a bell, or by any number of such blows given in succession. These aërial vibrations, like the waves upon the water, do not destroy or extinguish one another. If a whole orchestra, composed of numerous and diverse instruments, play a piece of music together, each pipe and each string will create its own system of vibrations, which will pass outward through the atmosphere without disorder, each being endowed with an individuality as indestructible as if it alone had disturbed the quietude of the still air.

If now we advance to the far more attenuated and elastic medium of light, the ether, we shall find the same law still hold good. Here, as in the water and in the air, one system of vibrations, whether set in motion immediately by the sun, or by reflection of the sun's rays from some terrestial object, does not interrupt or confuse another system. Each, though it may have crossed a hundred or a thousand others, maintains its existence and its identity unchanged, and



INTERSECTION OF TWO WAVE SYSTEMS.

bears on its bosom a correct and clear representation of the centre or object from which it has proceeded. These radiant vehicles of light are infallible in their progress and office; from ten thousand points, and in ten thousand directions, they unceasingly carry and imprint the messages of the world and of the universe.

If we enter the garden, and bend over a bed of diverse flowers, we shall find that each green leaf and each variegated petal sends forth its little system of ethereal vibrations, announcing infallibly its particular form and color. If we stand confronted by

a regiment of soldiers, the countenance of each individual, in like manner, sends forth its system of vibrations, and all meet in the eye, and imprint their pictures of those countenances on the retina within a circle that does not exceed in circumference that of a dime—not one is omitted; not one is blurred. Light treats all objects alike.

Our Solar System

A FINE family of planets is that over which the sun presides, and an accurate description of these will be of interest to the reader. We are now speaking of the orbs that revolve around him.

MERCURY.

Above the sun, in the west, when that radiant body sets, or again before its rising in the east, is seen sometimes a small white star, slightly tinged with red. The Greeks call it Apollo, god of day, and Mercury, the god of thieves, who take advantage of the night to commit their misdeeds; for they saw in it two different planets, one a morning and the other an evening one, as they did also for a long time in the case of Venus, the Egyptians and Indians doing the same. The former gave it the names of Set and Horus; the latter those of Boudda and Rauhineya; names which bring to mind, like the preceding, the divinities of day and night. The Latins who, however, employed themselves very little with astronomy, in this respect remained in doubt. It has been only in later times that the identity of these two stars which, like Castor and Pollux, to which they are assimilated, never appear together, has been proved; its evening name Mercury, was the one retained.

Being the first planet of the system, Mercury always remains absorbed in the royal radiation of the prince of day; also, like a courtier, it is deprived of its individuality and blended in the personality of the ruling star. It gains nothing and loses much, seeing that it had not the honor of being known to the founders of astronomy. Copernicus despaired of ever seeing it: "I fear," said this great man, "that I shall descend to the tomb without having seen the planet." And, indeed, he who had transformed the system of the world, and taken in hand each of the planets to place them round the sun, died without having seen the first amongst them. Galileo was able to observe it, thanks to the glasses which he had invented, but it could not be said that he understood it sufficiently, as it was impossible for him ever to distinguish its phases.

The adversaries of the new system opposed the first astronomers, Copernicus, Galileo, and Kepler, on account of the

absence of phases in the planets Mercury and Venus. "For," said they, "if these planets revolved around the sun, they would change their aspect to our eyes, as the moon does, according as we see in front, in profile, or in rear, the illumined part, the side in fact which they turn towards the sun."

Copernicus and his colleagues replied, "We do not distinguish any phases, it is true; but if it only requires them in order that you should adopt our system, God will cause that there may be some." Indeed there were some. By the observation of the irregularities visible in the interior of the crescent or quarter, it has been observed that Mercury is rugged with high mountains, higher than those of the earth, although Mercury is a much smaller globe than ours. The existence of a denser and higher atmosphere than ours has been suspected.

Grotesque Romances.

In the middle of the last century, one of the numerous romancers who feigned voyages to the planets, pretended to know that the mountains of Mercury were all crowned with beautiful gardens, in which grew naturally not only the most succulent fruits which served as food to the Mercurians, but also the greatest variety of dishes. It is better, perhaps, to believe this than to think with Fontenelle, that the inhabitants of Mercury are all mad, and that their brains are burned with the violent heat which the sun pours upon their heads. But until an authentic voyager has made us sufficiently acquainted on this head, we will confine ourselves to the astronomical elements of the planet.

It revolves at a distance of 35,000,000 of miles from the sun; its diameter is 2960 miles; its day is 24 hours, 3 minutes, 28 seconds long; its year, 87 days, 23 hours, 14 minutes; and its seasons, 22 days only; its mass, compared to that of the earth is only $\frac{17}{100}$; its density is three times more than ours, and bodies which fall on its surface travel 7.45 feet during the first second of fall; and, lastly, it receives six times and a half more light and heat than the earth does.



CELEBRATED ASTRONOMERS.

COPERNICUS.
GALILEO. ISAAC NEWTON.
KEPLER. TYCHO BRAHE.

VENUS.

Thou little sparkling star of even,
Thou gem upon an azure heaven!
How swiftly will I soar to thee
When this imprisoned soul is free!

The young poetess who sang this charming song, Maria Lucrecia Davidson, escaped from her earthly prison towards her well-beloved star when she had scarcely seen her

seventeenth spring blossom forth. Some ill-disposed minds have asserted that although Venus is beautiful afar, it is frightful on a nearer view. We fancy our young and amiable readers are not of this opinion.

Indeed all the magnificence of light and day which we enjoy on the earth, Venus posseses in a higher degree. Like our globe, it is surrounded by a transparent atmosphere, in the midst of which are combined thousands and thousands of shades of light. Clouds rise from the stormy ocean, and transport into the sky, snowy, silvery, golden and purple tints. At morning and evening, when the dazzling orb of day, twice as large as it appears from the earth, lifts its



CRESCENT AND SPOTS OF VENUS.

enormous disk at the east or inclines towards the west, the twilight unfolds its splendors and charms. From here we can be spectators of this distant spectacle; for we distinctly see the daybreak and the close of day in the plains of Venus.

Day and night are of nearly the same duration as on the earth; the diurnal period of rotation of the planet is twenty-three hours, twenty-one minutes, seven seconds; it is consequently thirty-five minutes less than ours. Its year is two hundred and twenty-four days. Its mountains are much higher than ours. The inequalities which are noticed in the interior of the crescent are the highest points of the surface which still receive the sun's rays after these have left the plain. The height can be concluded from the time that these light-points take to disappear.

Rapid Motions.

We have just spoken of Venus as a crescent. Like Mercury, this planet is situated between the earth and the sun; and the circle which it describes during its year is comprised in the circle which the earth describes round the same body. Hence it follows that at certain epochs the planet Venus is exactly between us and the sun; and then it presents its dark part to us, as its illuminated portion is naturally on the side of the sun. At other times, when it is to the right or left of the sun, it presents only a quarter. Lastly, when Venus is on the other side of the sun, it presents its entire illuminated portion to us. At such times it is one of the beauties of the firmament, a gem of the first water.

The phases of Venus were seen for the first time by Galileo in the month of September, 1610, who beheld this spectacle with a joy impossible to describe, seeing that it eloquently testified in favor of the system of Copernicus, showing that like the earth and moon, the planets receive their light from the sun. When we say that these phases were for the first time seen in the month of September, 1610, you must not conclude that they did not exist before that epoch, but you must understand, that before that year no one had turned the telescope to the planet, and that with the naked eye, these phases are imperceptible.

According to the custom of the period, the illustrious astronomer disguised his discovery under an anagram, to maintain

the authenticity of this discovery in case of rivalry, and to give himself time to continue his observation and to perfect them. He finished a letter with this phrase: "*Hæc immatura a me jam frustra leguntur, d. y.*" which means, "These things unripened and as yet hidden to others, are at length read by me."

Under this cryptogram, it would be difficult to discover the idea of the phases of Venus. Our farthers were very ingenious, and in the present time certain discoveries would not have been so greatly contested, if astronomers had sometimes used the same ruse. In this phrase there are thirty-four letters. By placing them in another order, we get these words, in which the whole discovery is elegantly inscribed: "*Cynthiæ figuras emulatur mater Amorum.*" "The mother of the Loves puts on the phases of the moon."

A Shrewd Reply.

Galileo was very cunning. Two months later, Father Castelli asking if Venus had phases, he replied, "My state of health is very bad, and I find it better to be in my bed than in the dew." It was only two days before the end of the year that he announced the above discovery.

This globe presents the greatest semblance to our own, and it has nearly the same astronomical elements, size, volume, weight and density; only it is much nearer to the sun than we are. From the commencement of ancient poetry, its position near the sun, which causes it to appear at sunrise and sunset, attracted contemplative minds towards it. In the middle ages, a worthy father took an ecstatic voyage in the heavens, and in Venus saw only young people of ravishing beauty, living in the midst of perfect happiness; in his sight, these were the guiding spirits of the planet Venus, for in olden times it was believed that a legion of angels or genii presided over the direction of each of the heavenly spheres.

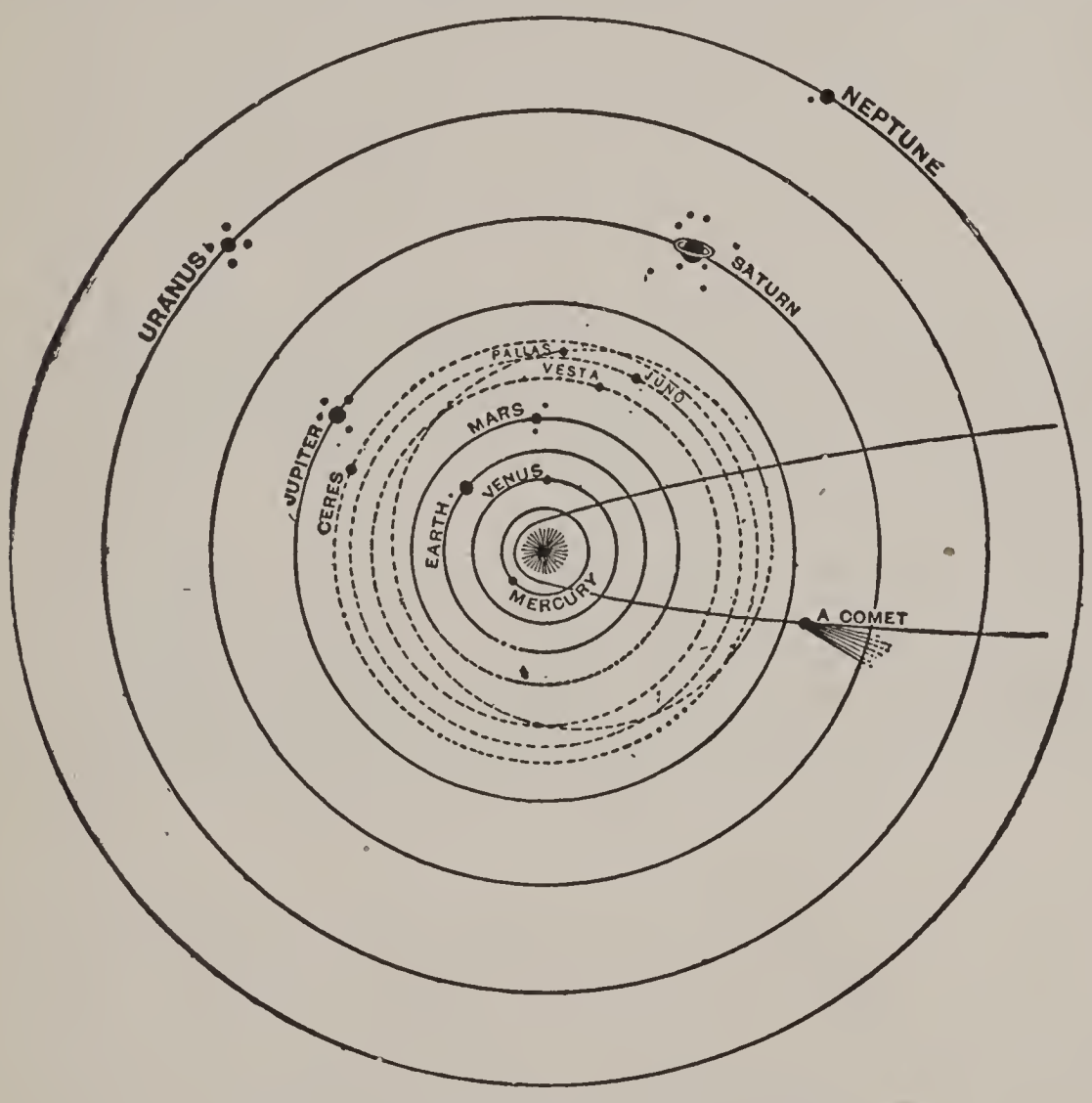
MARS.

All the maledictions of mortals have fallen on Saturn and Mars. Beginning with war, that scourge of humanity of which it will have great trouble to rid itself, all public misfortunes caused by power have been attributed to Mars, which, if it knew what the earth thought of it, ought to regard us with an evil eye. It is, nevertheless, innocent of all these calumnies, and we ought not to speak ill of it, presenting, as it does, most resemblance to ourselves. Indeed the world of Mars resembles the earth so much, that if we happened one day to be traveling there and lost our way, it would be almost impossible to recognize which of the two were our planet. Without the moon, which would charitably remove our uncertainty, we should run a great risk of arriving amongst the inhabitants of Mars, expecting to descend into the United States, or some other terrestrial quarter.

Indeed, the planet Mars in our telescopes presents the same aspect as the earth must do to the inhabitants of Venus; a circular disk, rather flattened, turning on itself in about twenty-four hours, furrowed from time to time by fleeting clouds, diversified with here dark and there light plains, revolving obliquely on an axis enveloped with an atmosphere and with snow-covered poles. On this planet the seasons are nearly of the same intensity as our own, but their duration is twice as long; for Mars only accomplishes its annual revolution around the sun in 1 year, 321 days, and 22 hours, or 1 year, 10 months and 21 days.

We may notice certain differences be-

tween the aspect of Mars and our own world. Whereas the earth seen at a distance must appear tinted with green, on account of the color of its atmosphere, its vegetation and water, Mars is shaded with red, and it is this shade which gives it the reddish light with which it is seen to shine. Doubtless this characteristic color is produced by the dominant coloring of its surface; either its soil is thus colored like that of our deserts, or its seas, its vegetation, or the vapors



THE SUN, PLANETS AND COMET.

rising into its atmosphere, are chiefly clothed with this shade. Nevertheless, the poles always preserve their brilliant light. In 1837, it once happened that Mars was, during the observations, completely darkened by a cloud, with the exception of the poles which stood out distinctly.

Removed from the sun to a mean distance of 139,000,000 of miles, and encircling the the earth's orbit in that which it describes round the central body, there are certain periods where these planets are very near together; that is, when they are both on the same side of their path with regard to the sun. Sometimes they are not more than 48,000,000 of miles distant from each other. Mars has two satellites, which have been discovered at a comparatively recent date.

The conjunction of two planets is the point of their orbits where they are on the same side of the sun, and are the nearest possible to each other; the term opposition is given to the opposite point of their paths, when they are on opposite sides of the sun, except in the case of Mercury and Venus. In olden times these positions greatly exercised the sagacity of horoscope-seekers, and human destinies received fancied predictions, according as the god of war was in conjunction in such and such a sign of the zodiac.

The Little Worlds.

The interior planets, Venus and Mercury, whose orbits are enclosed in that of the earth, have no opposition, but they have two conjunctions; the superior, when the planet is beyond the sun and in one right line; the inferior, when it is situated between the sun and the earth. The exterior planets, those which enclose the terrestrial orbit, and of which Mars is the first, have only the superior conjunction.

At about 80,000,000 of miles, beyond the planet Mars, between the orbit of this planet and that of Jupiter, we meet with the group of small planets, of which we have already spoken. These are very little worlds, if even they deserve this name, which have

scarcely the extent of a province, or even a department. They gravitate in this zone in considerable numbers, for there may exist several thousands. Perhaps they are *débris* of a larger world, shattered by some catastrophe; perhaps they have been formed in this region of space in the fragmentary state in which we now see them.

Putting aside the title of original greatness of these asteroids, and the fate which attends them, let us traverse their colony, and beyond it get near the most magnificent of the worlds of our system.

JUPITER.

She said:
Oh! that it were my doom to be
The spirit of yon beauteous star,
Dwelling up there in purity,
Alone, as all such bright things are:—
My sole employ to pray and shine;
To light my censer at the sun!

The orb of Jupiter is more bulky than all the other planets of our system; it is only a thousand times smaller than the sun, which makes it, if we remember the volume of that radiant body, from fourteen to fifteen hundred times larger than the terrestrial globe. Also, although it revolves in an orbit nearly 475,000,000 of miles distant from the sun, and receives a much fainter light than that received by the earth, its size is evidenced by the light with which it shines during our starry nights, equal and often superior to that with which Venus shines. Jupiter is therefore reckoned among the most beautiful objects of the heavens. As it is always in the zodiac, and when Venus is visible in the evening, it is always in the west, it is easily recognized. At whatever period of the year, therefore, you see a very bright star, either in the east, or high up among the zodiacal constellations, you may be certain that it is Jupiter.

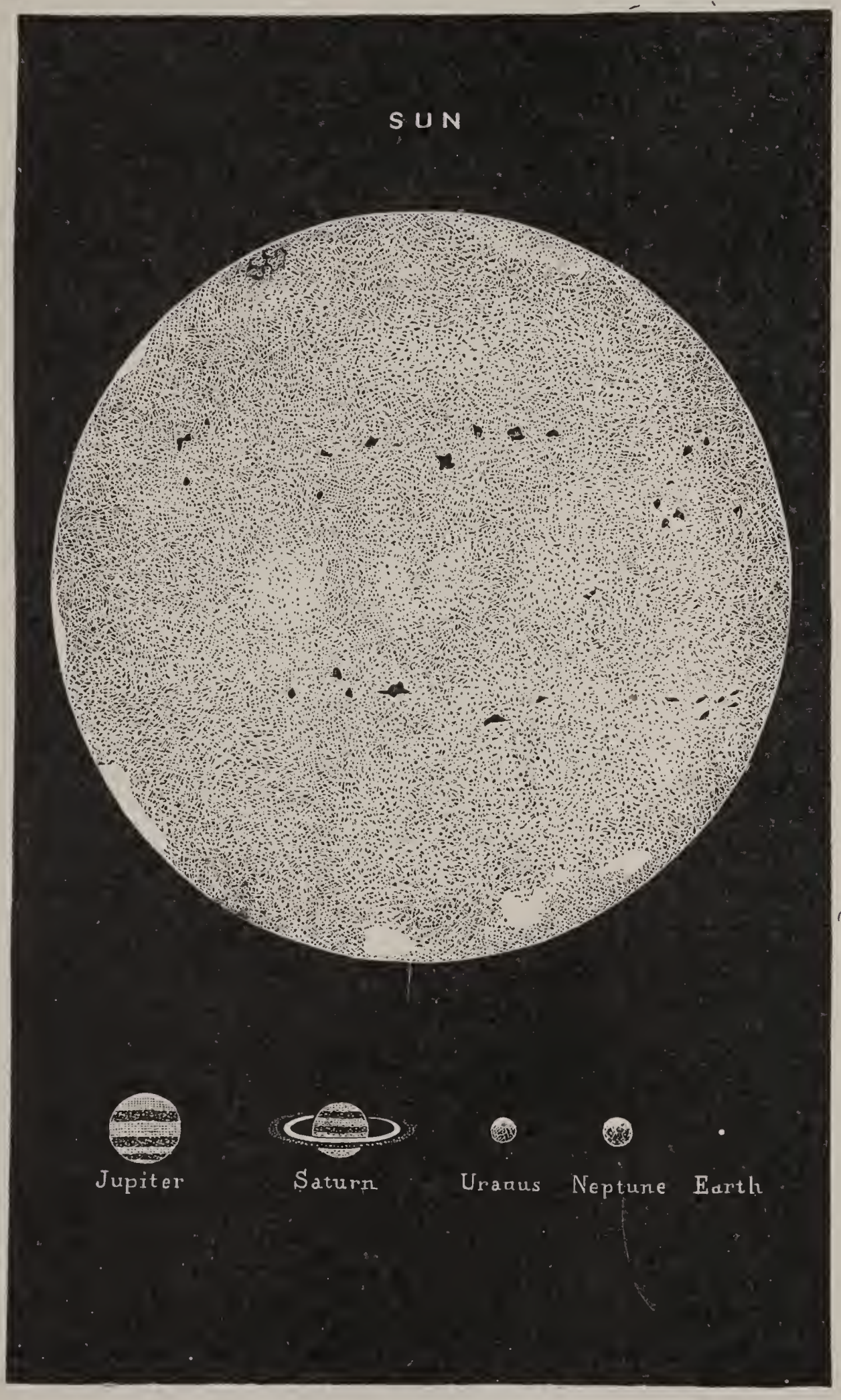
This planet is a charming one, so far at least as we are able to judge from afar and without going there. To begin with, a continual spring rejoices its surface. If it is ornamented with flowers, which we do not doubt, though we know not of what these flowers consist, they do not only survive "the span of a morning," as our roses do, but live much longer. Scarcely have the oldest begun to dry up and fade but they are replaced by lovely buds, opening before the first have died away. Not only is the Jovian year equal to twelve of ours, but it is scarcely known when the yearly period begins or ends.

The King of the Planets.

Then Jupiter presents a surface 126 times more extensive than the terrestrial surface. We speak of surface, not volume. Now, a hundred and twenty-six earths placed side by side, and on which the human race would be able to spread itself at will, would constitute a very fine country. We ought, then, not to doubt that such an empire has been formed to serve as an abode for a race of beings, venerable and worthy of our respect. We reason thus of Jupiter, because we have had the necessary means to measure and appreciate it at its just value. But it is necessary to add something to complete the comparison between this world and our own.

Because we find, by observation of the Jovian planet, excellent reasons for believing that its inhabitants are very favored, it does not follow that the aforesaid inhabitants make similar reflections on us. There is a very good reason why they do not occupy themselves with us—they are probably not acquainted with our existence. And, indeed, if ever, at a future time, more or less distant, you should happen to inhabit Jupiter, you would have great trouble to discover

your old country. To do so you would have to rise a little before the sun (and mark, there are only five hours from the setting to the rising of this body on Jupiter) and five or six minutes before the rising look to the east for a very small white star. With good eyes, you perhaps would perceive it. In this case, you would know that our earth exists.



RELATIVE SIZES OF THE SUN AND PLANETS.

Again, you would make the same search six months later, at the west, a few moments after the setting of the sun. Such is the condition of the inhabitants of Jupiter with regard to us. They can never see the earth during the night, although it is precisely in the middle of clear nights that we are best able to observe this magnificient planet.

SATURN.

If you were to take a journey to the planet Saturn, which is scarcely more than 900,000,000 of miles from us, you would feel on approaching it an unspeakable astonishment, to which certainly no sentiment of surprise felt on the earth can be compared. Imagine an immense globe, not only of the size of the earth, but as large as 734 earths put together. It revolves on an axis with such rapidity, that in spite of its size it accomplishes its diurnal rotatory movement in about ten hours. Around it, at 20,000 miles distance above its equator an immense ring, flat and relatively very thin,

surrounds it on all sides. This ring is followed by a second, and this one by a third.

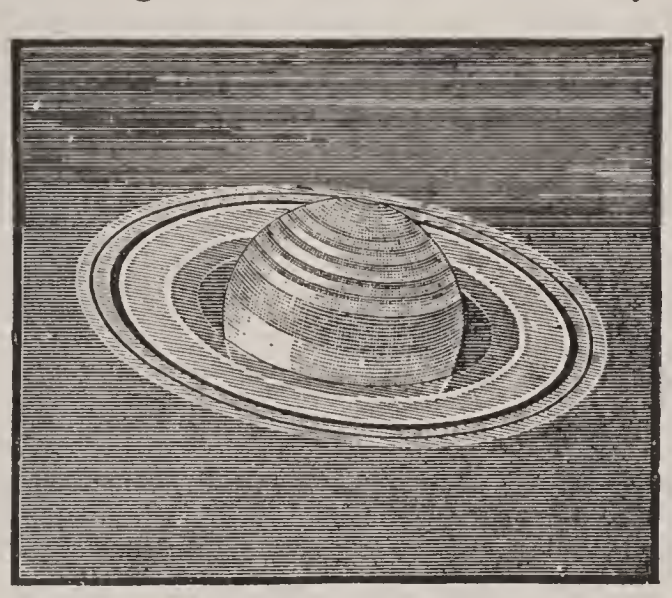
Now this system of multiple rings is only a few miles thick, while its diameter is 166,000 miles. They do not remain immovable, but are carried along with a circular movement round the planet, this movement being of still greater rapidity than that of the planet itself. The domain of the Saturnine world is not confined to this. Beyond the ring, eight moons are seen revolving in the heavens around this strange system; the nearest of these satellites is separated from the planet's centre by a distance of 120,000 miles; the most remote has an orbit of 2,293,000 miles from the centre of the planet. Saturn then governs a system which measures not less than four and a half millions of miles in diameter.

By the side of this world the earth makes but a poor figure, and Micromegas, in the fable, was to be pardoned when on coming out of Saturn he mistook the earth for a molehill. Its years are thirty times longer than ours; of its seasons each lasts seven years and four months; a change remarkably like that which distinguishes our own diversifies them; a regenerating spring succeeds the rigor of winter; summer and autumn pour forth their alternate fruits.

URANUS.

On the 13th of March, 1781, between ten and eleven in the evening, a quondam organist of Halifax, who had himself made the best telescope then in existence, observed the small stars of the constellation of the Twins, with a telescope of nine feet focal length, and a magnifying power of 227. During his observation he perceived that one of the stars presented an unusual diameter. Astonished and desiring to prove the fact, he took an eyepiece magnifying double, and found that the diameter of the star increased whilst that of the others remained the same. More and more surprised, he fetched his magnifying power of 932, being quadruple that of the first, and again observed it. The mysterious star was still larger.

From that time, he no longer doubted; this was a new body, not a star. He continued the following days, and noticed that it slowly moved among the others. It was then a comet. Herschel described it to the Royal Society in a paper entitled, "Account of a Comet;" and the scientific world of all countries registered this new cometary body,



THE PLANET SATURN.

and set about observing it in order to determine its orbit. If Herschel had directed his telescope towards the constellation of the Twins eleven days sooner, said Arago, the real movement of Uranus would have escaped him, for this planet was on the second at one of its stationary points. It may be seen by this remark on what the greatest astronomical discoveries depend.

The name of the astronomer was then so little known that it is found written in every way; Mersthel, Herthel, Hermstel, Horochelle. Nevertheless, the discovery of a new comet was an event important enough to induce a study of the new body. Laplace, Mechain, Boscowich and Lexell endeavored

to determine the orbit along which it moved. Many months elapsed before the astronomers guessed that it was a real planet; and it was not until after having observed that all the imagined orbits for the pretended comet were soon contradicted by observation, and that it probably had a circular orbit, much more distant from the sun than Saturn, until then the boundary of the system, that they agreed to regard it as a planet.

The New Member of the Family.

Still this was but a provisional agreement. It was, indeed, more difficult than was thought thus to increase unscrupulously the family of the sun. Many reasons of propriety were opposed to it. Old ideas are tyrannical. It had been the custom for so long to regard the venerable Saturn as keeper of the frontiers, that it required a great effort to determine upon extending these frontiers, and guarding them by a new world. It happened in this as in the discovery of the small planets situated between Mars and Jupiter.

Two years before this discovery was made, Kepler imagined, for the harmony of the world, a large planet in this space, and the most frivolous and senseless considerations were urged against it. For instance, they reasoned: "There are only seven openings in the head, the two eyes, the two ears, the two nostrils, and the mouth; there are only seven metals, there are but seven days in the week, therefore there are but seven planets," etc. Considerations like these, and others no less imaginary, often hinder the progress of astronomy.

When William Herschel, having been present as a spectator at the debates created by his discovery, came to the belief that his comet was a planet situated at the confines of our system, he claimed the right, which was indisputably his, of christening the new star. Animated by a lawful motive of gratitude towards George III., who had appreciated his astronomical worth and given him an annual pension, he at first proposed the name of Georgium Sidus, George's star, as Galileo had called the satellites of Jupiter discovered by him, the Medici's stars, and as Horace had said Julium Sidus.

Others proposed the name of Neptune, in order to preserve the mythological character; Saturn would be thus found between his two sons, Jupiter and Neptune. Others added to Neptune the name of George III., others again proposed Astræ, considering the goddess of Justice was as far as possible from the earth; Cybele, mother of the gods; Uranus, the most ancient of all to whom reparation was due after so many hundred years of neglect. Lalande suggested Herschel's name to immortalize the discoverer. These two denominations prevailed.

For a long time the planet bore the name of Herschel, but custom has since declared for the mythological appellation of Uranus. The discovery of Uranus has increased the radius of the solar system from 872,000,000 of miles to 1,753,000,000. Compared with the preceding, this planet is not very large, for it is scarcely eighty-two times more bulky than the earth. Its seasons last twenty-one years, of ours, and its years eighty-four years and a quarter. Around it revolves eight satellites, six of which Herschel himself discovered.

NEPTUNE.

The world which here marks the frontiers of the system, is situated at such a distance from the sun, that the light and heat which it receives from it are thirteen hundred times less than that with which the earth

is enriched, so that no great difference can be noticed between the day and night of this distant planet, and to it the solar disk is nearly reduced to the smallness of the stars.

In Eternal Twilight.

Two billions seven hundred and forty-six millions of miles is the distance which separates this world from the sun. Until the time of its discovery, the frontiers of the planetary system already augmented by the addition of Uranus, were confined to an orbit of 1,753,000,000 of miles in radius. Does this, then, imply that these are the utmost limits, and that analysis will not be able to go further and add fresh members to the already increasing family of the sun? No; when observations spreading over a long series of years shall have been made, and compared with each other, the universal law of gravitation by which the existence of this planet was known before ever being perceived in the field of the telescope, will prove the existence of others if others exist, which is probable; and the progress of optics following equally the progress of astronomy will give to the visual power, again magnified, the power to discover such distant planets which will, doubtless, be of the sixteenth or seventeenth magnitude.

Imagine a body a hundred times larger than the earth carried into the gloomy deserts of space to the distance of the Neptunian orbit. It floats, isolated, in the obscurity of space, following an immense but purely ideal curve, and which exists only in theory in the decree of eternal laws. It follows this curve, and revolves on itself without ever deviating from its path. To finish its immense route and return to its starting point, it requires one hundred and sixty-four years. It will return and again pass through this mysterious point of space which it passed nearly two centuries before.

What power moves it? What hand guides this blind body through the night of the distant regions, and what causes it to describe this harmonious curve? It is universal attraction.

Instead of following a regular ellipse round the sun, the planet Uranus underwent, from some unknown cause, a perturbation, which retarded its theoretical path, and extended its circular curve towards a certain point, as if an attractive cause had seduced the traveler from its path, and had made it deviate from its proposed route. It was calculated that, in order to produce at this point an attraction of such intensity, it was necessary that there should be on that side of the system beyond Uranus, a planet of a certain mass, and at a certain distance.

A Remarkable Discovery.

Two astronomers, the one French, the other English, set to work at the same time in this research. They discovered the disturbing cause theoretically, and observers directed their telescopes to the spot thus indicated by theory. They were not long in actually discovering the body near the spot pointed out, and they were able to announce to the world the most brilliant confirmation of universal gravitation.

This discovery justly ranks as one of the most celebrated among the dazzling triumphs of astronomical science. If anything in creation might be expected to be circumspect and steady, it is one of the planets, like Neptune, that helps to form the solar system. But like a swift-running locomotive, it swayed, trembled, threatened to leave the track. "Surely," said the astronomer, "there must be some world beyond that is drawing it." And there was.

The Earth's Satellite

OUR earth is not rich in respect to satellites, possessing as it does only one, which, however, is of dimensions ample enough as compared to it; this is the moon, the faithful companion of its course. Other planets, it is true, like Jupiter and Saturn, are more richly endowed, and have from four to eight satellites; but again there are others which do not possess any, as is the case with Venus and Mercury.

The sole and faithful satellite of the earth, formed by a fragment detached from it, now cold and wan, rolled round us when it began, a red and blazing sphere, vomiting torrents of fire from its whole surface. Whilst gravitation was regulating its form and path, the moon, in the course of thousands of years, exhausted its fires to show us at last its pale and silvery face, the sad luminary of our nights, the splendid nocturnal mirror which reflects to us, pale and cold, the divergent rays of the sun.

Compared to the immeasurable distances of the nebulæ and stars, the space which separates us from our satellite is quite insignificant; she is our next-door neighbor and the eye can so clearly discern her form and peculiarities, that she seems almost to touch us But this insignificant distance, abstractly considered, is yet vast enough. The distance from the earth to the moon is about 237,000 miles. If it were possible to get there by means of steam, it would require one year and about three hundred and twenty-two days for a locomotive starting from our globe and traveling at a high rate of speed to reach the moon and land its passengers; yet this is but a step compared to the distances of the stars.

Grand Lunar Mountains.

The moon is in every part roughened with eminences of different shapes, but they only very rarely group themselves into mountain chains comparable to those of our globe. The Alps, Caucasus, and the Apennines represent the principal ones. Certain isolated summits have received the names of celebrated men, but those of past times have been chosen in order not to excite any jealousy; we travel from the Mountain of Aristotle to that of Hipparchus, from that of Ptolemy to that of Copernicus. The astronomers have very properly not forgotten their claims.

The highest lunar mountains attain an altitude which surpasses most terrestrial elavations, a fact which may well astonish us. Generally they do not rise beyond 22,750 feet. But in proportion to the size of the planet, we may say that the mountains in the moon are much loftier than those of the earth. The summits of Mount Dœrfel are

24,700 feet above the valleys which environ it, whilst the crest of Mont Blanc only rises 15,632 feet above the level of the sea.

Most of the mountains of our pale companion are of volcanic origin, and its surface has been so shattered by subterranean fires that in many places the craters are heaped up close beside each other. Probably no star was ever so horribly torn by the fury of volcanoes. These even attain proportions far beyond what is seen in our globe. Some of those lunar craters are four or five leagues in diameter, and the gaping mouth of the volcano of Aristillus, still more prodigious, is ten leagues from one ridge to the other! Our glasses enable us to see these extinct craters in such proportions, that none of their details escape us; whilst, were we on the moon, our telescopes, according to Humboldt, would scarcely enable us to make out terrestrial volcanoes.

Seen from the earth many lunar volcanoes appear very much depressed, and the edges of their craters resemble so many flattened rings, projecting very little above the plains. Some regions are so riddled with them that their mouths touch. Others surmount lofty summits, and their crenelated ramparts surround enormous excavations, which pierce deep into the mountains below.



VOLCANIC CRATERS ON THE MOON'S SURFACE AT SUNSET.

It seems strange to say that the geography of the moon, or at least of much of that portion of her surface which is presented to our view, is better known than that of many parts of our own earth; and yet this is quite true. Our telescopes are of such power that if there were an object on the moon's surface as large as the Capitol at Washington, they would surely reveal it to us.

Formerly the dark patches which cover part of the moon's surface were considered as representing lunar seas, but at present men are disposed to look upon them as only immense plains. The first astronomers gave them names full of poetry. There was the Sea of Tranquility, the Sea of Clouds, the Sea of Nectar, the Ocean of Tempests, and the Sea of Serenity.

The rocky and shattered soil of our satellite is perfectly bare; not a blade of grass grows there, not a flower opens. Totally deprived of water and air, life is an impossibility. A threefold death would overtake the least animal that happened to alight there; a squirrel would perish of hunger, thirst, and asphyxia! In these cold and horrid realms of the moon, everything is plunged in torpor and silence; the echoes are mute, and the breath of a zephyr never plays around the summits of the rugged mountains.

A Desert World.

By means of our instruments, which have now been brought to so great perfection, we can pry into the minutest details of our satellite, and examine them with as much accuracy as if it were some distant view on earth; hence we can, to a certain extent, make out its geological disposition. The precision of our glasses has been carried to such a pitch, that we could with them easily perceive large buildings, if any existed on the lunar surface; we could even make out troops of animals moving about. It would, it is true, be impossible to perceive one of its inhabitants traversing the valleys of its silver crescent, but if the much spoken of Selenites existed, we should certainly perceive their movements when they were collected into dense masses. According to Humboldt, however, there is only a noiseless, silent desert there.

Sir Walter Scott gives us, in one of his fine poetical outbursts, this apostrophe to the lunar world:

> Hail to thy cold and clouded beam,
> Pale pilgrim of the troubled sky!
> Hail, though the mists that o'er thee stream
> Lend to thy brow their sullen dye!
> How should thy pure and peaceful eye
> Untroubled view our scenes below?
> Or how a tearless beam supply,
> To light a world of war and woe?

There is a great contrast, not only apparent but real, between the serene tranquility of the lunar disk and the great movements which are ceaselessly carried on on the surface of our world. On approaching the moon nothing is seen of the physical causes which make the earth a vast laboratory wherein a thousand elements contend or unite with each other.

There are none of those tumultuous tempests which sometimes sweep over our undulated plains; none of those hurricanes which descend in waterspouts to be swallowed up in the depth of the sea; no wind blows, no cloud rises to the heavens. There white trains of cloudy vapors are not seen, nor those laden masses with heavy cohorts; the rain never falls, and neither snow, nor hail, nor any of the meteorological phenomena are manifested there.

Silence and Death.

But, on the other hand, the magnificent tints which color our sky at sunrise and twilight, the radiation of the heated atmosphere, are never seen there; if winds and tempests never blow, neither is there the balmy breeze which descends npon our coasts. In this kingdom of sovereign immobility, the lightest zephyr never comes to caress the hilltops; the sky remains eternally asleep in a calm incomparably more complete than that of our hottest days when not a leaf moves in the air. This is because on the surface of this strange world there is no atmosphere. From this privation results a state of things difficult to realize.

In the first place, the absence of air implies also the absence of water and every liquid, for water and liquids can only exist under atmospheric pressure: if this pressure is taken away they evaporate and their beds are dried up. Thus, for instance, if you

place a vessel filled with water under the receiver of an air-pump, and then, by pumping out the air which is in the receiver, you make a vacuum, you will soon see the water boil, even when the place where the experiment is made is frozen with the most intense cold. The boiling disengages vapors, and, finally, the water is evaporated. Now let us suppose, that, at a certain period of its past existence the moon had, like the earth, seas and rivers, and that by the aid of any apparatus, its seas and rivers were made to boil and to fall into vapor again; by continuing this operation long enough the moon would be made completely dry: this is precisely what has happened.

Since the distant period of its formation in a fluid state, it has lost all its liquids and vapors, and now a linnet would die of thirst in the midst of the seas of the moon. These seas do not contain a drop of water. These, it will be said, are singular seas. And, indeed, no one will hold that their title is logical. But we have seen that they were named at a time when people did not know the lunar surface sufficiently well to guess that it existed without air and water.

From the absence of air follows another very curious fact—the absence of sky. An immensity without depth is traversed by the sight, and in the day as in the night are seen the stars, planets, comets, and all the bodies of our universe. The sun passes among them without extinguishing them, as it does to us. Not only does the moon not possess this perpetual diversity which the movements of the air produce on our world, but it has not the azure vault which covers the earth with such a magnificent dome; space is a black and a perpetually black abyss.



TELESCOPIC VIEW OF THE MOON.

Whilst on high there reigns darkness, below there is silence. Not the least sound is ever heard; the sigh of the wind in the woods, the rustling of foliage, the song of the morning lark, or the sweet warbling of the nightingale never awakens the eternally dumb echoes of this world. No voice, no speech has ever disturbed the intense solitude with which it is overspread. Unchange-

able silence reigns there in sovereignty. Tall perpendicular mountains divide its surface. Here and there are seen worn out craters rising towards the sky, white rocks heaped up like the ruins of some long-passed revolution, crevasses crossing the surface as in lands dried by the burning rays of long summer days.

That which renders the spectacle more strange is that the absence of vapors causes the absence of perspective as well as the absence of all tints, and we see only white or black according as the object is in the sun's light or in shadow, the objects succeeding each other as far as the horizon without losing brightness or contour. The moon is such a singular world that its mountains may be measured as well by depth as height. This paradox, rather difficult to understand, arises from the fact that the mountains of the moon are not like those of the earth, but are hollow. When we arrive at the top there is a ring, the white, rugged and sterile mountains, and lofty and deserted craters.

These solitary and dried-up landscapes remind us of what Fontenelle said regarding the changes at work on the surface of our satellite, caused, not by the movements of life, like those which regulate terrestrial nature, but by the simple falling down of lands. "Everything is in perpetual motion," he says. "Even including a certain young lady, who was seen in the moon with a telescope about forty years ago, everything has considerably aged. She had a pretty good



PART OF THE MOON'S CRESCENT DURING THE FIRST QUARTER.

face, but her cheeks are now sunken, her nose is lengthened, her forehead and chin are now prominent to such an extent, that all her charms have vanished, and I fear for her days."

"What are you relating to me now?" interrupted the Marchioness.

"This is no jest," returned the author. "Astronomers perceived in the moon a particular figure which had the aspect of a woman's head, which came forth from between the rocks, and then occurred some changes in this region. Some pieces of mountain fell, and disclosed three points which could only serve to compose a forehead, a nose, and an old woman's chin."

Gleaming Mountain Crests.

We do not know whether the face, of which the ingenious writer speaks, existed anywhere but in his imagination; but changes, even caused by simple fallings, are extremely rare, if even they are still produced. For a hundred years, for instance, during which period a day has not elapsed in which the moon has been visible, without it being observed by the telescope, the slightest movement has never been noticed.

At the commencement of the century, it is true, people fancied they observed active volcanoes, but they have since discovered that very probably what were then taken for volcanoes were nothing more than the white crests of certain mountains, their form or their structure being more favorably adapted to reflect light. Thus the orb of night remains dumb and silent. Why this sad and solitary fate? This is the question asked by the poet Shelley:

> Art thou pale for weariness,
> Of climbing heaven and gazing on the earth,
> Wandering companionless
> Among the stars that have a different birth,
> And ever changing, like a joyless eye
> That finds no object worth its constancy.

Now that we have pointed out how the moon is an inhospitable world, poor and destitute of nature's gifts, it is necessary to retrace our steps, and show it to you as a magnificent world, worthy of admiration and esteem. We do not wish to contradict the foregoing words; but in order not to leave a bad impression with regard to our faithful friend, we wish to remind you that nature, even when it appears to disgrace some of its works from some points of view, favors them with very desirable riches when regarded under other aspects.

A Magnificent Spectacle.

To an astronomer, the moon would be a magnificent observatory. In the daytime he could observe the stars at noon, and thus discover, without trouble, that they reside eternally in the heavens. With us, on the contrary, among the ancients, were a great number who imagined that they were lighted up in the evening and extinguished in the morning. If, then, people make astronomical observations on the moon, the sun is not a tyrant who governs the heavens absolutely; it allows the stars to be enthroned peaceably with it in space; and studies commenced during the night can be carried on without difficulty during the day until the following night.

On our satellite the nights are fifteen times twenty-four hours long, and the days are of the same length; but there is an essential difference to remark between the nights of the lunar hemisphere, which faces us, and those of the hemisphere which we do not see.

You must have noticed that the moon always presents the same side to us. From the beginning of the world it has never shown but this side. We read in Plutarch, who wrote nearly two thousand years ago,

a thousand conjectures relative to the side of the moon always turned toward us. Some said it was a large mirror, well polished and excellent, which sent back from afar the image of the earth ; the dark portions represented the oceans and seas, while the bright portions represented the continents.

Others believed that the spots were forests, where some placed the hunts of Diana, and that the most brilliant parts were the plains. Others, again, saw in it a very light, celestial



THE EARTH AS SEEN FROM THE MOON.

earth ; they stated that its inhabitants must pity the earth which is below them, and which is only a mass of mud. Others, again, and their singular opinion was widely spread, added that the beings who peopled it were fifteen times larger than those of our earth, and by the side of the lunar trees our oaks would only be small bushes. All this to explain the nature of the lunar face eternally turned towards us.

Now, if we never see but one side of the moon, it follows that there is only one side of this body which sees us ; so that half of the moon has a moon—namely, our earth, and the other half is deprived of one. If there are any inhabitants on the hemisphere turned from us, they do not guess that the moon is only a body placed for illumination of our nights, and they must be greatly astonished when the narratives of travelers relate to them the existence of our earth in the heavens. If the travelers there resemble those here, what tales must they spread with regard to us? But, also, how useful must the earth be to the lunar nights, and how beautiful we are—from afar!

Silvery Splendors.

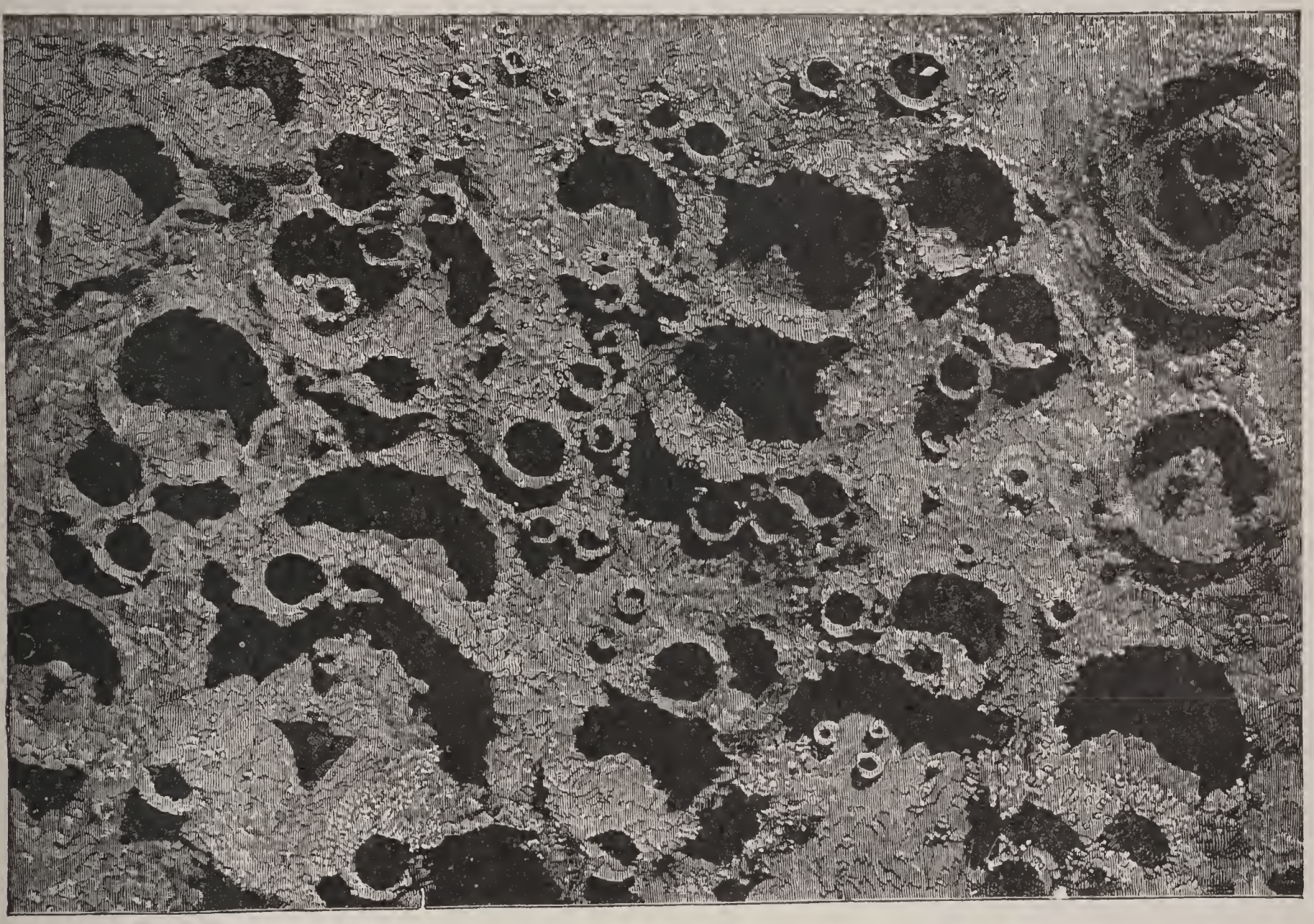
Fancy to yourself fourteen moons like that which gives us light, or more properly speaking, a moon with fourteen times the extent of surface, and you will have an idea of the earth as seen from the moon. Sometimes it only presents a fringed crescent, a few days after the new earth ; sometimes it presents the first quarter ; sometimes it shines out with its full disk, spreading its silvered light in floods. The most fortunate thing is, that it begins to shine precisely in the evening, that its brightest light, its full disk, is precisely at midnight, and that it fades away in the morning at the time when it is no longer required. And it is known that from the evening to the morning is fifteen times twenty-four hours with our neighbors the Selenites.

How much more reasonable are these

inhabitants than we are in believing that the moon was created and placed in the world expressly for them, and that we are only their very humble servants!

The lunar caverns form a very peculiar and prominent feature of the moon's surface, and are to be seen in almost every region, but are most numerous in the southwest part of the moon. Nearly a hundred of them, great and small, may be distinguished in that quarter. They are nearly of a circular shape, and appear like a very shallow egg cup. The smaller cavities appear within almost like a hallow cone, with the sides tapering towards the centre; but the larger ones have, for the most part, flat bottoms, from the centre of which there frequently rises a smal lconical hill, which gives them a resemblance to ridges and mountains.

In some instances their margins are level with the general surface of the moon; but in most cases they are encircled with a high ridge of mountains marked with lofty peaks. Some of the larger of these cavities contain smaller cavities of the same kind and form, particularly in their sides. The mountainous ridges which surround these cavities reflect the greatest quantity of light; and hence that region of the moon in which they abound appears brighter than any other.



SINGULAR ASPECT OF THE MOON'S SURFACE.

From their lying in every possible direction, they appear, at and near the time of full moon, like a number of brilliant streaks or radiations. These radiations appear to converge towards a large brilliant spot surrounded by a faint shade, near the lower part of the moon, which is known by the name of Tycho, and which every one who views

the full moon even with a common telescope, may easily distinguish.

In regard to their dimensions, they are of all sizes, from three miles to fifty miles in diameter at the top; and their depth below the general level of the lunar surface varies from one-third of a mile to three miles and a half. Twelve of these cavities, as measured by Schroeter, were found to be above two miles in perpendicular depth. These cavities constitute a peculiar feature in the scenery of the moon, and in her physical constitution, which bears scarcely any analogy to what we observe in the physical arrangements of our globe.

A Remarkable Crater.

It is a curious fact that the surface of the lunar hemisphere was known before that of our own earth, and the heights of all its mountains were measured before the same thing was done for our own. The volcano of Aristillus in particular was one of the first and best known. Lecouturier, the author of a very good map of the moon, gave a long description of it, and this description may be applied to the most of the lunar mountains. It is composed of a crater about twenty-four miles across, from the centre of which rise two cones, the highest of which attains nearly 984 yards; the whole is surrounded by a circular rampart.

When the bottom of the crater is examined with a powerful telescope, and under favorable circumstances, numerous rough portions are noticed which seem to indicate hardened lava and blocks of rock heaped together. From this mountain, taken as a centre, start five or six lines and rocky ramifications directed towards the east and south. These ramifications give rise to the radiation of Aristillus. They are surmounted by an enormous quantity of peaks or basaltic columns which rise from their summits, and make them resemble from afar the multitude of bell towers that are seen on some Gothic cathedrals. Aristillus presents the general aspect of most of the mountains of our satellite.

Thus the moon would appear very inhospitable to us. The sense of speech, like the sense of hearing, would be lost, and, consequently, would not exist. To the privation of these two senses, perhaps, must be added an inferiority in the pleasures which sight gives to us, seeing that wherever the eye would be directed, it would only meet with a scene of comparative desolation.

It is doubtless this proximity which has caused the great reputation of the lunar orb amongst us. No celestial body, except the sun, has ever had a similar influence. The whole world, it was supposed, was accessible to the lunar influences, men, animals, plants, minerals. The astrological opinions with regard to this body were most singular. We must quote some; they are really too curious to be passed over in silence. Let us choose one or two good astrologers, learned on the moon, and let us question them.

Curious Opinions.

Cornelius Agrippa, a famous geomancer, thus expresses himself: The moon is called Phœbe, Diana, Lucinus, Proserpine, Hecate, who governs the months, half-formed; who illuminates the nights, wandering, in silence, with two horns; queen of divinities, queen of heaven, who rules over all the elements, to whom respond the stars, to whom return the seasons, and whom the elements obey; at whose direction the thunders sound, the seeds germinate, the germs increase; the primordial mother of fruits, heart of Phœbus, shining and brilliant, carrying light from one planet to another, illuminating by her light

all the divinities, stopping various intercourses with the stars, distributing the light rendered uncertain on account of meetings with the sun; queen of beauty, mistress of shores and winds, giver of riches, nurse of men, governor of all states good and unhappy; protecting men by sea and land, moderating the reverses of fortune; dispensing with destiny, nourishing all which comes out of the earth, arresting the insults of phantoms, holding the cloisters of the earth closed, the heights of heaven luminous, the currents of the sea salutary, and ruling at will the deplorable silence of the lower regions, governing the world, treading Tartarus under foot; of whom the majesty causes the birds which fly in the sky, savage beasts in the mountains, the serpents hidden under the earth, and the fish in the sea, to tremble.

According to Eteilla, the moon governs comedians, butchers, tallow and wax chandlers, ropemakers, lemonade-vendors, publicans, playwrights of all kinds, masters of great works, menageries of animals; and, on the other hand, professional gamblers, spies, sharpers, cheats, bankrupts, false money-coiners, and mad-houses; that is to say, the moon rules over all those whose business it is to work during the night until sun-rising, or to sell provisions for the night; and it also rules over all which people would be ashamed to commit in full day, in sight of those who have manners. Thus each reader may easily find out what denomination he is and what it is that governs him.

Amazing Distances

SPACE has neither beginning nor end. The heavens are infinite space, indefinite expanse, a void without limits; no frontier circumscribes them, they have neither beginning nor end, neither top nor bottom, right or left; there is an infinity of spaces which succeed each other in every direction. The earth is a little material globe, placed in this space without support of any kind, like a bullet which sustains itself alone in the air, like the little captive balloons which rise and float in the atmosphere when the thin cord which retains them is broken.

A multitude of suns, surrounded like ours with a family of which they are the foci and the light-givers, float likewise in all parts of the expanse. These suns are the stars with which the fields of heaven are scattered. In spite of the appearance caused by perspective, immense spaces separate all these systems from ours, spaces so great that the highest figures of our great numeration can scarcely number the smallest amongst them. A distance that our figures can scarcely express also separates these stars from each other, extending from depths unto depths.

Notwithstanding these prodigious intervals, these suns are in number so considerable that their numeration as yet exceeds all our means; millions joined to millions are inadequate to enumerate the multitude! Let the mind try, if it is possible, to represent to itself at one time this considerable number of systems and the distances which separate them one from the other! Confused and soon humbled at the aspect of this infinite richness, it will only learn to admire in silence this indescribable wonder.

Heavens Piled on Heavens.

Continually rising on the other side of the heavens, going beyond the distant shores of this ocean without limits, it will endlessly discover fresh new space, and new worlds will reveal themselves to our eager gaze, heavens will succeed to heavens, spheres to spheres; after deserts of expanse will open other deserts, after immensities other immensities; and even when carried away without rest, during centuries, with the rapidity of thought, the soul would continue its flight beyond the most inaccessible limits that imagination could conceive,—there even the infinite of an unexplored expanse would remain still open before it; the infinite of space would oppose itself to the infinite of time; endlessly rivalling, without our ever being able to take away from the other: and the spirit will be arrested, overcome with fatigue, at the entrance of infinite creation as if it had not advanced a single step in space.

Ye stars! bright legions that, before all time,
Camped on yon plain of sapphire, what shall tell
Your burning myriads but the eye of Him
Who bade through heaven your golden chariots wheel?
Yet who, earth-born, can see your hosts, nor feel
Immortal impulses—eternity?
What wonder if the o'erwrought soul should reel
With its own weight of thought, and the wild eye
See fate within your tracks of deepest glory lie?

The immensity of the heavens has been sung on many lyres; but how can the song of man express such a reality? Poets have tried to render it in verse, when one feels the insufficiency of speech to note the immense thoughts which this wonderful contemplation develops in us.

Marvelous Flight Through Space.

We wish to open space before us and employ ourselves there, in trying to penetrate its depth. The velocity of a cannon-ball from the mouth of the cannon makes swift way, 437 yards per second. But this would be too slow for our journey through space, as our velocity would scarcely be 900 miles an hour. In nature there are movements incomparably more rapid, for instance, the velocity of light. This velocity is 186,000 miles per second. We will place ourselves on a ray of light and be carried away on its rapid course.

Taking the earth as our starting-point, we will go in a straight line to any point of the heavens. We start, and at the end of the first second, we have already traversed 186-000 miles; at the end of the second, 372,000 We continue: ten seconds, a minute, ten minutes have elapsed—111,600,000 miles have been passed. Flying away during an hour, a day, a week, without ever slackening our pace—during whole months, and even a year, the time which we have traversed is already so long that expressed in miles, the numbers exceed our faculty of comprehension, and indicate nothing to our mind; they would be trillions, and millions of millions.

But we will not interrupt our flight Carried on without stopping by this same rapidity of 186,000 miles each second, let us penetrate the expanse in a straight line for whole years, fifty years, even a century—

where are we? For a long time we have gone beyond the last starry regions which are seen from the earth, the last that the telescope has visited; for a long time we travel in other regions, unknown and unexplored. No mind is capable of following the road passed over; thousands of millions joined to thousands of millions express nothing: at the sight of this prodigious expanse the imagination is arrested, humbled.

Well! this is the wonderful point of the problem: we have not advanced a single step in space. We are no nearer a limit than if we had remained in the same place; we should be able again to begin the same course, starting from the point where we are, and add to our voyage a voyage of the same extent; we should be able to join centuries on centuries in the same itinerary, with the same velocity,—to continue the voyage without end and without rest; we should be able to guide ourselves in any part of space, left, right, forwards, backwards, above, below, in every direction; and when after centuries employed in this giddy course, we should stop ourselves, fascinated or in despair before the immensity eternally open, eternally renewed, we should again understand that our flights had not measured for us the smallest part of space, and that we were not more advanced than at our starting point. In truth, it is the infinite which surrounds us, as we before expressed it, or the infinite number of worlds. We should be able to float for eternity without ever finding anything before us but an eternally open infinite.



CYCLONE OF SPIRAL NEBULA.

In the bosom of infinite space, the unfathomable extent of which we have tried to comprehend, float rich clusters of stars, each separated by immense intervals. These rich groupings of stars have received the name of nebulæ. This name was given at the time of the invention of astronomical lenses, when these starry tribes were distinguished only under a diffused, cloudy aspect, which did not enable the eye to distinguish the com-

posing stars. This appearance not revealing in any way the idea of solar clusters, it was thought that they were only phosphorescent vapors, whirlwinds of luminous substance, or possibly primitive fluids, whose progressive condensation would in the future effect the formation of new stars. The first nebula observed by the aid of the telescope and pointed out as an object of particular nature, the nebula of Andromeda, was considered for three centuries and a half as entirely deprived of stars.

Infinite Clusters of Stars.

Only a few years ago a Cambridge astronomer counted within the limits of this nebula 1500 little stars, notwithstanding which, the centre still keeps the aspect of a diffused light, in spite of the best instruments. Later, the astronomer Halley thought no more of the star-clusters.

Thus, infinite space must be represented as an immense void in the bosom of which are suspended archipelagoes of stars. These archipelagoes are themselves of infinite number; the stars which compose them can be counted by millions, and from one to the other the distance is incalculable. They are distributed in space in every direction, following every imaginable course, and invested with every possible form.

The fixed stars are in reality suns, many of them thousands of times larger than our little sun.

The existence of binary stars was discovered by Sir William Herschel toward the close of last century. It had long been noticed by astronomers as a remarkable coincidence that, in several instances, a pair of bright stars were found in close proximity to each other, much closer than we should have expected, supposing the stars to have been scattered up equally distant from all its four suns. A green and a red sun are above the horizon, and when we look directly at either, its color is clear, brilliant and well-defined. But their rays meet and mingle and unite into a dazzling snowy white, which imparts to the whole landscape the pure radiant look which seems to fill the firmament on a sunny day when the ground is covered with snow. A light cloud-wreath steals over the green sun, and a faint rosy blush overspreads the face of the sky. The cloud thickens, and the rosy hue deepens into a mellow crimson.

Then the green sun sets and a blue one rises, changing the red light of the sky into a rich purple, veined here and there with pale amethyst, as a few rays from the green sun struggle through the clouds just as it sinks beneath the horizon. The purple changes into a deep gold as the blue sun is succeeded by an orange one, and the gold pales down as the red sun sinks to his rest in turn. The orange is left alone, and when it, too, sets, night comes on apace.

All the Colors of the Rainbow.

And now the moons rise and shed their radiance on the scene. But how differently do they show from the pale uniform light that beams from our own plain satellite! Every color of the rainbow glows from their faces; in belts, in spots, in lunes, their checkered disks reflect every shade of hue that the artist's palette can produce.

The parts illumined by one sun alone reflect, more faintly than the rest, the colors of their respective orbs; those which come within the light of two or three of them will shine more brightly and with gayer combinations of colors; while in the parts on which all the four suns shine at once we find again the snowy white, so bright as to sparkle almost with the light of day.

But where there are four great lights to rule the day, night will be of unfrequent occurrence and of short duration; and soon the four suns, their noctural course ended, begin at once to draw nigh to their rising. Pale, slender threads of red, green, blue, and orange steal out from the darkness in four quarters of the horizon; and these widen and lengthen till they mingle together at their extremities in softly shading hues of white, indigo, and gold. Brighter and broader they grow, and the gorgeous variegated belt spreads rapidly from horizon to zenith, till at last the suns have fairly risen, and their many-colored rays combine again into the dazzling white of the perfect day.

Magnificent Constellations

REPRESENTATIVE maps were formed of the heavens by the ancients, and from the time of Hipparchus, the Greek astronomer, they were able to class the stars, distingushing them according to their brightness. The bright clusters are called constellations, and the ancient astronomers gave them, for the most part, the names of animals according to their supposed resemblance to some representative of the animal kingdom.

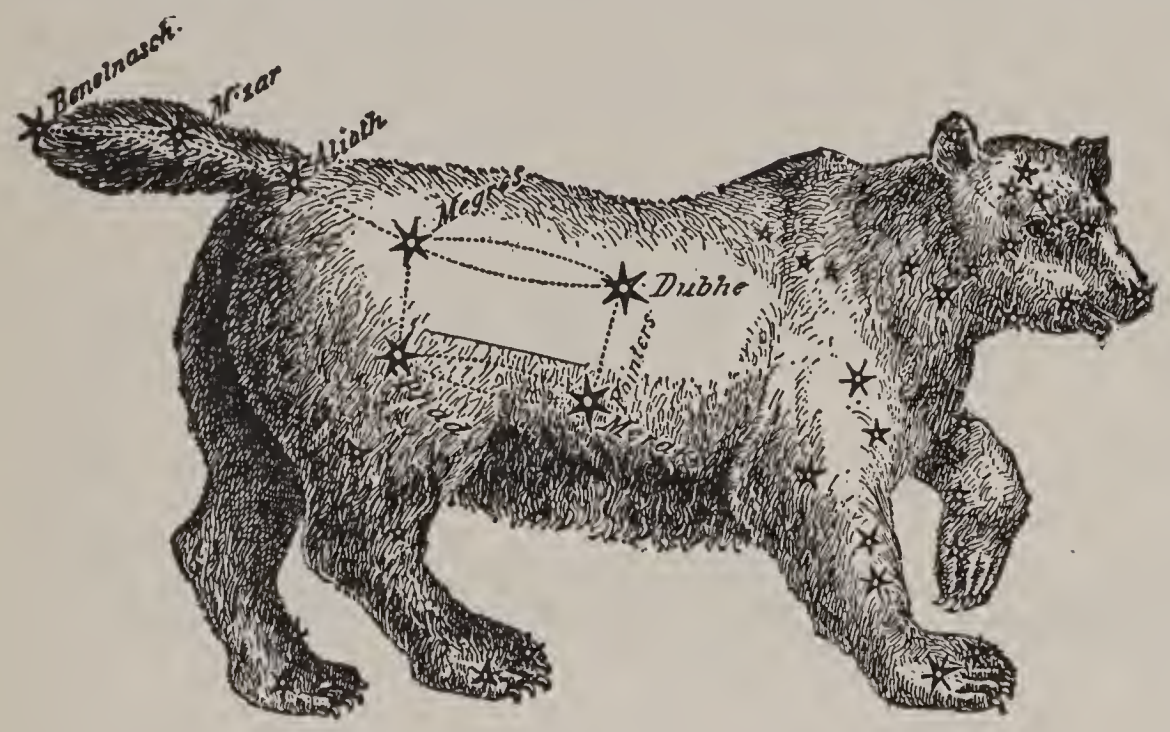
Let us form the geography of the heavens. The innumerable figures of animals, men or objects, with which the sphere is adorned, will not all be drawn here, seeing that they would only serve to confuse the mind with imaginary lines. Formerly they printed celestial atlases, where the figures were represented with exquisite care, so much so, indeed, that they ended by forgetting the stars, and the sky was nothing more than a menagerie. In spite of the interest of the images, we will not follow this example. At present, let us see how to direct our course for reading correctly the great book of the heavens.

THE GREAT BEAR.

There is one constellation known to everyone; for greater simplicity we will begin with it, as it will serve as a starting-point to go towards the others, and as a sign to find its companions. This constellation is the Great Bear, which has also been called David's Chariot, or Charles's Wain; which the ancients called *Septem triones* (whence came the word *septentrion*), or, again, *Helix*, *Plaustrum;* which the Greeks addressed under the name of *Arktos Megale;* which the Arabs called *Aldebb al Akbar*, and the Chinese, three thousand years ago, addressed as the *Tcheou-pey*, the god of the north. Thus it can boast of a high celebrity.

If, however, in spite of its universal notoriety, some have not yet had occasion to make its acquaintance, the following is the sign by which it may always be recognized.

Turn towards the north, that is to say, opposite the spot where the sun is at noon. Whatever may be the season of the year, the day of the month, or hour of the night, you will always see there a large constellation formed of seven stars, four of which are



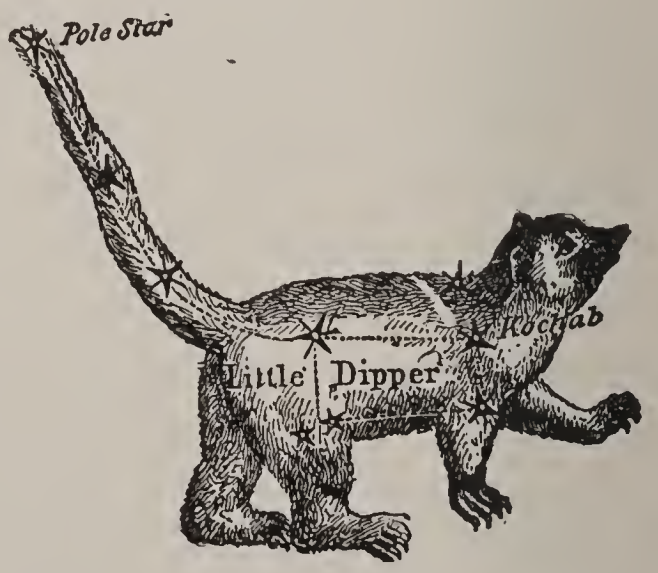
URSA MAJOR, OR GREAT BEAR.

quadrilateral, and at a right angle with the side.

Have you not all seen it? It never sets. Night and day it watches above the northern horizon, turning slowly in four-and-twenty hours around a star of which we shall speak presently. In the figure of the Great Bear, the three stars of the extremity form the tail, and the quadrilateral forms the body. In the Chariot the four stars form the wheels, and the three the car. Above the second between these latter, good sights distinguish a very small star called Alcor, which is also called the Cavalier. The Arabs used it to test a good eye.

This constellation is also called the Big Dipper, from its supposed resemblance to a dipper. If a straight line be carried through the two stars on the side opposite the handle, a star less brilliant than the preceding ones is found, which forms the extremity of a figure like the Great Bear, but smaller and directed in a contrary direction. This is the Little Bear, or Little Chariot, also formed of seven stars. The star to which our line brings us, that which is at the extremity of the Bear's tail, or at the end of the shaft of the Chariot, is the Pole-Star. Always found in its place, it is an example of fidelity.

The Pole-Star has a certain renown, like all personages who distinguish themselves from others, because, among all the stars which twinkle in our starry nights, it remains immovable in the heavens. At any moment of the year, day or night, if you observe the sky, you will always find it occupying the same place. All the other stars, on the contrary, revolve round it every twenty-four hours, a hold for the centre of this immense whirlpool! The Pole-Star remains immovable over one pole of the world, whence it is used as a fixed point by navigators of the pathless ocean, as well as by travelers in an unexplored desert.



URSA MINOR.

CASSIOPEIA.

Looking at the Pole-Star, stationary in the midst of the northern region, we have the south behind us, the east to the right, the west to the left. All the stars revolving around the Pole-Star, from right to left,

ought to be recognized according to their mutual relations rather than according to the cardinal points. On the other side of the Pole-Star, relating to the Great Bear, is another constellation easily recognized. This is Cassiopeia, which is formed of five stars of the third magnitude, arranged somewhat like the slanting strokes of the letter M. This group takes every possible position, going round the pole; sometimes being above, sometimes below, sometimes to the left and sometimes to the right; but it is always easy to find, seeing that, like the preceding constellation, it never sets and is always opposite



TAURUS OR BULL.

to the Great Bear. The Pole-Star is the axle around which these two constellations revolve.

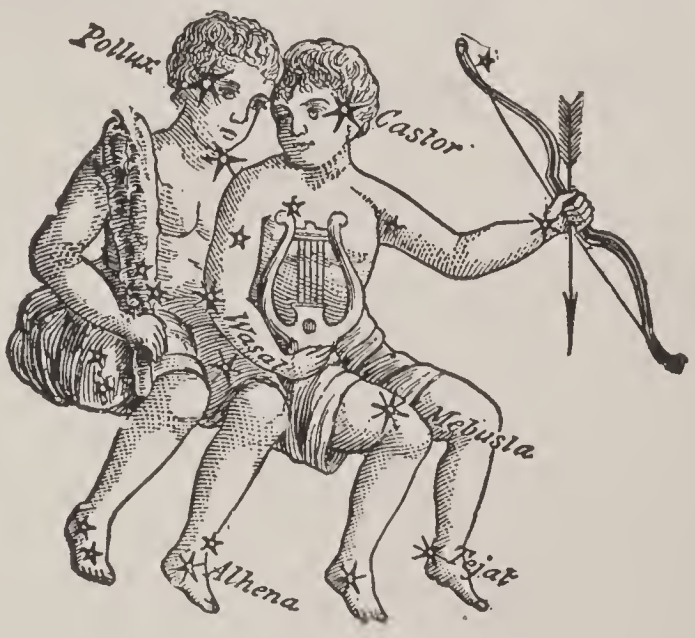
We go from west to east. We shall easily recognize the Bull by the group of the Pleiades which sparkle on its shoulder, by that of the Hyades which glimmer on its forehead, and by the magnificent star which marks its right eye, the star Aldebaran, of the first magnitude. It is, moreover, situated just above the splendid constellation of Orion.

The Pleiades, which are seen in the annexed engraving, are a group of about 80 stars, resolved by the telescope. The ancients counted in the Pleiades seven stars more brilliant than the ground sprinkled with golden dust. At the present time only six can be counted with the naked eye. Alcyone in Pleiades appears to be the central point of the universal heavens.



CASSIOPEIA.

This region, marked with Orion, Sirius, the Twins, the Goat, Aldebaran and the Pleiades, is ths most magnificent region of the celestial sphere. It is towards the end of Autumn that it shines in our hemisphere



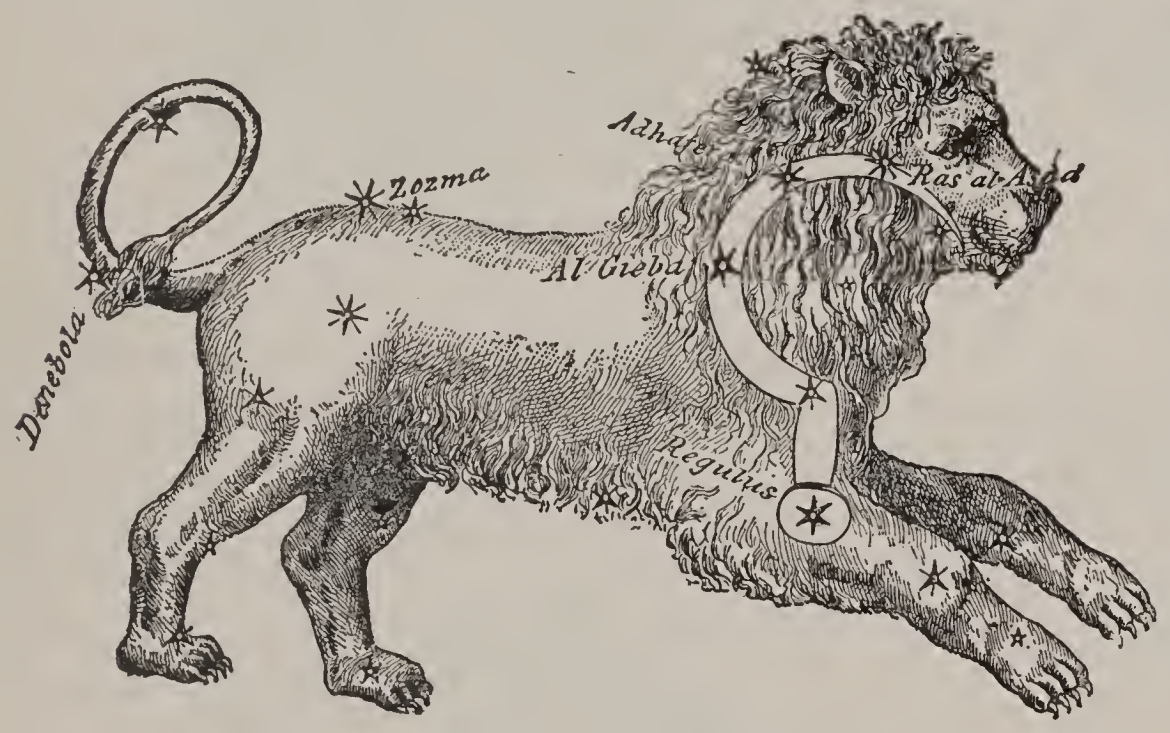
THE TWINS.

in the evening. The Twins are, in the fable, Castor and Pollux, sons of Jupiter, celebrated for their indissoluble friendship, for which they were rewarded by immortality. The Greeks also gave the name of Castor and Pollux to those lights which appear round

vessels after storms, electrical phenomena now called the fires of Saint Elmo.

The Crab or Cancer may be distinguished at the bottom of the line of Castor and Pollux, in five stars of the fourth or fifth magnitude. It is the least important body of the zodiac. While Hercules was fighting the Lion of Nemea, the Crab, aiding the vengeance of Juno, pinched the heel of the hero, who crushed it with his foot, but the queen of heaven gave it its reward by placing it in the heavens.

The Lion is a cluster of beautiful stars, situated to the east of the Twins. The most



LEC, OR THE LION.

brilliant of these stars is of the first magnitude, and is called Regulus, the heart of the Lion; the three others are of the second magnitude. The sun enters the Lion at the summer solstice, and causes it to disappear by covering it with his fires; this is the victory of Hercules over the Lion of Nemea. It was also for the same cause the symbol of strength and power. Being the abode of the sun during the month of July, it was again the sign of burning heats and of plagues which they sometimes brought with them. In the eyes of astrologers of the middle ages, this was its terrible aspect. The Virgin comes after the Lion.

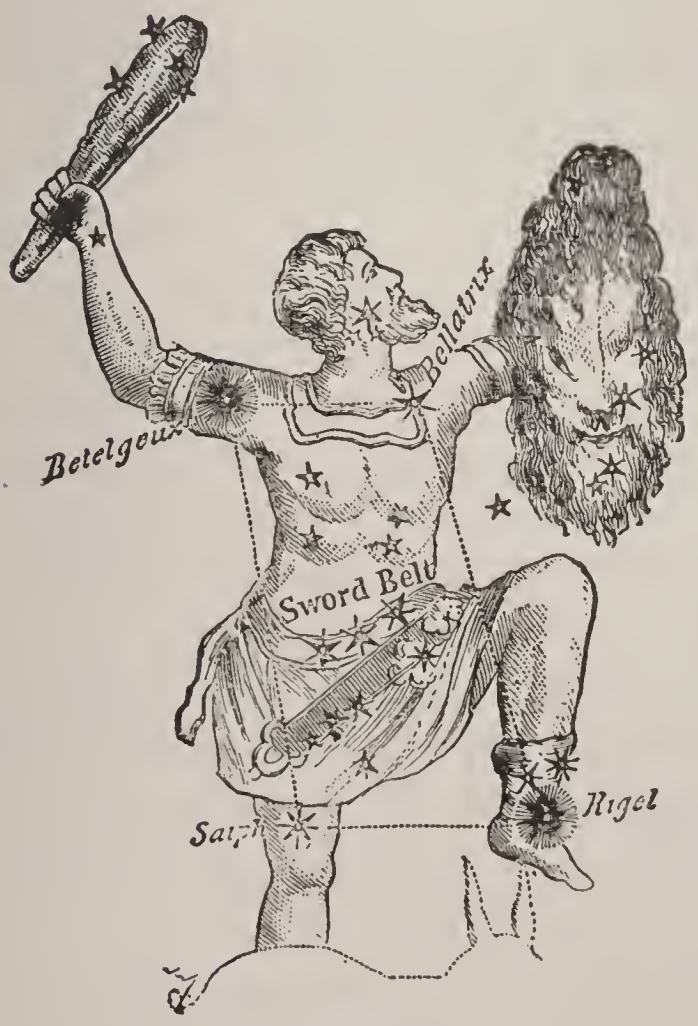
Copernicus (the He-goat) is not rich in bright stars. Those which sparkle on his forehead, are the only ones which can be distinguished by the naked eye. In some authors Copernicus represents the goat Amalthea, which nursed Jupiter on Mount Ida, and received a place in heaven as a reward. According to others, it represents the return of the sun to the winter solstice through the gates of the tropics. Again, according to others, it was a he-goat which was brought up with the king of the gods, and which discovered and sounded the marine trumpet, and produced fear among the Titans in their war with Olympus. The frightened gods hid themselves in the forms of different animals; Apollo changed into a crane, Mercury into an ibis, Diana into a cat. Such a metamorphose was never seen. Lastly, Pan nto Capricornus, having a goat's body and the tail of a fish. He appeared, also, to wish to steal away with the giants who scaled heaven.

Aquarius forms with his three tertiary stars a very obtuse triangle. The base is prolonged in a string of stars from the side of Capricornus, and towards the left to the Urn. Thence begins a sinuous line of very small stars descending to the horizon. This is the water poured out by Aquarius. Aquarius appears to personify Ganymede, who was raised by Jupiter's eagle to serve as cup-bearer to the gods after the downfall of Hebe.

The Scorpion, with its heart marked by the brilliant Antares, a star of the first magnitude, is easily recognized. It is not that the form can be distinguished; for this form is not better sketched out by the stars which compose it, than the preceding figures have

been. But it is well understood that, when we speak of recognizing a constellation, we refer simply to the groups of stars which bear its name and not to its mythological figure. The Scales and Scorpion only formed one sign, with the Latins before Augustus: the Scales were then the claws of the Scorpion. As Augustus was born on the 23d of September, flattery leagued itself with astrology to celebrate the happiness promised to the earth by the birth of this emperor; the Scales, which the Egyptians had formerly instituted in the original sphere, were replaced in the heavens as a symbol of Justice.

The verses of the Eneid may now be easily interpreted. As a sign of misfortune and fear, the Scorpion was cursed among all the constellations. It was said, especially, that it had an invincible hatred towards Orion, because this figure sets when the former rises, and *vice versa*. It was not only the terror of the stars, but also the terror of the sun himself, that Ovid has described it to us.



ORION.



THE SCORPION.

ORION.

Among the southern constellations Orion is the most beautiful; we must not pass it without doing homage to it. It is during fine winter nights that this constellation shines over our heads. No other season is so magnificently constellated as the winter months. Whilst nature deprives us of certain enjoyments on the one hand, it presents us with others no less precious. The wonders of the heavens present themselves to us from the Bull and Orion at the east, as far as the Virgin and Boötes at the west; of eighteen stars of the first magnitude, which may be counted in the whole extent of the firmament, a dozen are visible at nine o'clock in the evening, not counting many beautiful stars of the second order and the remarkable nebulæ worthy of the attention of mortals.

Thus it is that nature establishes everywhere harmonious compensation and, whilst it darkens our short and frosty winter days, it gives us long nights enriched with the wealthiest creations of the heavens.

The constellation of Orion is not only the richest in bright stars, but it conceals also treasures for the initiated which no other can present. We might almost call it the California of the heavens. Let as speak first of its nebulæ, situated below the second star of the Belt.

This has been minutely examined and the different regions of its cluster have been studied and described in all their details. In proportion as the instruments have become more powerful, the stars, which constellate it, appear more numerous, which has happened in all telescopic observations of nebulæ; and, whilst in early days it was asked with great uncertainty if there was only a phosphorescent cloud, a vaporous mass—astronomers afterwards arrived at the conviction that it was formed of an immense number of heaped-up suns.

It occupies a large space in the sky, its apparent dimension being equal to that of the lunar disk. When we think of the distance which separates us from this agglomeration, we are dismayed at the real extent which it embraces in the midst of the boundless void and limitless expanses of the sky.

Strange Wanderers in Space



COMETS are tailed bodies that suddenly come to light up the heavens, and were long regarded with terror, like so many warning signs of divine wrath. Men have always thought themselves much more important than they really are in the universal order; they have had the vanity to pretend that the whole creation was made for them, whilst in reality the whole creation does not suspect their existence. The earth we inhabit is only one of the smallest worlds; and therefore it can scarcely be for it alone that all the wonders of the heavens, of which the immense majority remains hidden from it, were created.

The word comet is derived from a Greek word signifying hair, a title which had its origin in the hairy appearance often exhibited by the haze of luminous vapor, the presence of which is, at first sight, the most striking characteristic of eomets.

The chief point of difference between them and the planets is, that their orbits are very

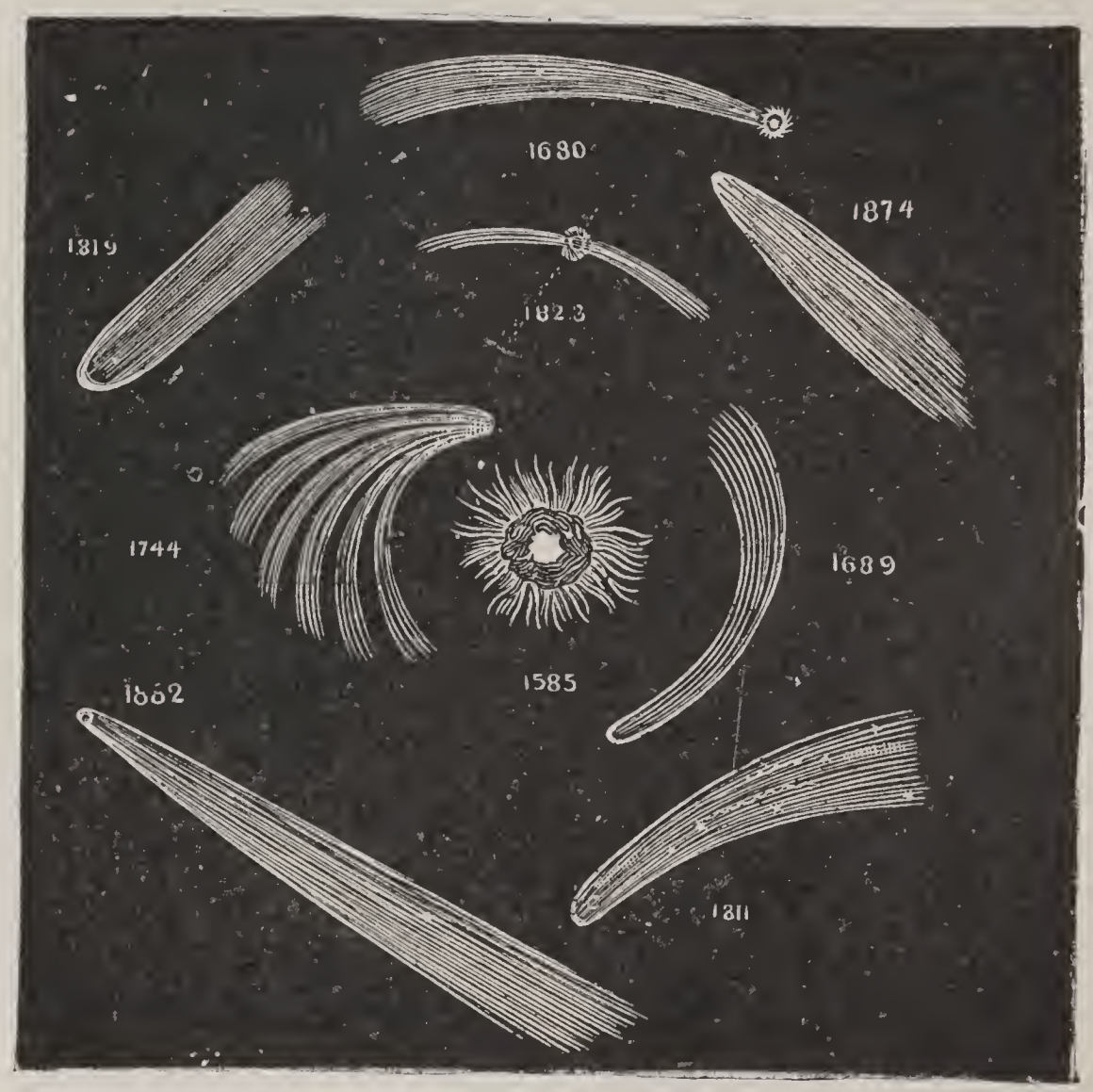
elongated; and, instead of being nearly circular, they take the elliptical form. In consequence of the nature of these orbits, the same comet may approach very near the sun, and afterwards travel from it to immense distances. Thus, the period of the comet of 1680 has been estimated at 3000 years. It approaches the sun, so as to be nearer to it than our moon is to us, whilst it recedes to a distance eight hundred and fifty-three times greater than the distance of the earth from the sun.

Great Velocity.

On the 17th of December, 1680, it was at its perihelion—that is, at its greatest proximity to the sun; it is now continuing its path beyond the Neptunian orbit. Its velocity varies according to its distance from the solar body. At its perihelion it travels thousands of leagues per minute; at its aphelion it does not pass over more than a few yards. Its proximity to the sun in its passage near that body caused Newton to think that it received a heat 28,000 times greater than that we experience at the summer solstice; and that this heat being 2000 times greater than that of red-hot iron, an iron globe of the same dimensions would be 50,000 years entirely losing its heat.

Two thousand years ago, Seneca wrote: A day will come when the course of these bodies will be known, and submitted to rules, like that of the planets. The prophecy of the philosopher is realized. It is now known that, like the planets, comits gravitate round the sun, and depend equally on its central attraction. Only, instead of moving in orbits, circular, or nearly so, they describe oval curves—very long ellipses. This is the great distinction established between them and planets. Instead of being opaque, heavy, and important bodies like our planets, they are of great lightness, and extreme tenuity.

But there are many comets which astronomers can prove will never again return to



VARIOUS FORMS OF COMETS WITH THE DATES OF THEIR APPEARANCE.

the neighborhood of the sun. They come from the remote depths of space, at a stupendous distance from the sun and all his train of planets; on beginning to feel the effect of his attraction they move towards our system, and at length they come sufficiently near to it to be visible through a telescope, and as surely as they do so, so surely are they detected by the keen eyes of some of the numerous astronomers who are always

on the watch for these bodies. They come on nearer to the sun, till their pace exceeds that of the earth itself, but they do not plunge headlong into him.

Notwithstanding the vast powers of his attraction, they just whirl around the mighty luminary. Exposed to the fearful heat of his beams, the tail is developed to an enormous length. By some unknown law, which Professor Tyndall has recently sought to explain in a very ingenious manner, the tail stands out away from the sun as the comet whirls around it; then, after having passed the sun, the comet retreats again. It gradually becomes fainter, gradually is lost sight of by our telescopes, gradually plunges again into the depths of space, never again to revisit our sun, never again to be beheld by human eye. Such is the history of many of the great comets which at different times have struck terror into the inhabitants of the earth—they have retreated never more to return.



THE GREAT COMET OF 1843.

The great comet of 1843 was one of the most remarkable ever observed. The nucleus of this was so brilliant that it could be seen with the greatest ease in full daylight. This comet is remarkable for coming nearer to the sun than any other of these bodies whose paths have been determined with accuracy. It was found to approach the sun to within a distance of thirty-three thousand miles. It is easy to calculate, though not easy to imagine, what must be the heat in such a position. It would doubtless be many hundred times greater than the temperature of molten iron.

Strange Visitors.

The distinctive character of comets lies especially in the length of their course, and in the immense duration of their journeys round the sun, through the celestial regions. The following lines are by the poet Conder:

Mysterious visitant, whose beauteous light
Among the wondering stars so strangely gleams!
Like a proud banner in the train of night,
The emblazon'd flag of Diety it streams—
Infinity is written on thy beams;
And thought in vain would through the pathless sky
Explore thy secret course. Thy circle seems
Too vast for Time to grasp. Oh, can that eye
Which numbers hosts like thee, this atom earth descry?

Meteorites are those solid fiery bodies which from time to time visit the earth, sweeping through the sky with immense velocity in every direction, and remaining visible but a few moments; they are generally attended by a luminous train, and during their progress explosions usually occur, followed by the fall of stones, to which the name of aërolites is given.

We must not confound the magnitude of the meteorite with that of the aërolite, for the latter is nothing more than a fragment thrown off from the former and falling to the earth, while the main body sweeps onward in its course. The diameter of the Weston meteorite was computed to be 300 feet, and that of a meteorite observed at Windsor, in August, 1783, was calculated to be no less than 3210 feet, or more than three-fifths of a mile.

Meteors or shooting stars may be occasionally seen on any clear night, but it is about the middle of August and November that the display is most brilliant. Sometimes meteoric showers of several hours' duration are witnessed. Meteors are supposed to be small bodies revolving around the sun, like the planets, in orbits which cross that of the earth. When the earth in its annual revolution arrives sufficiently near, under the influence of its attraction they approach it with great velocity, and on entering the atmosphere of the earth they take fire. In most cases they are consumed before reaching the earth, and thus disappear in the sky.

Sometimes, however, when the mass is large, a loud explosion takes place, and fragments from a few pounds to a ton in weight fall to the ground. In one case a meteoric stone nearly ten tons in weight was found in France. Such wanderers from far distant space or from other worlds are made up of materials similar to those we find in the earth—iron, nickel, quartz, talc, etc. These meteors, when large, are often inexpressibly brilliant. One seen at Hurworth, England, in 1854, lit up the heavens for half an hour with as bright a light as that of the sun, and finally burst with a thunderous explosion, heard for many miles.



THE GREAT METEOR SEEN AT HURWORTH.

The periodical meteoric showers of August and November are caused by our orbit carrying us, at those periods of the year, right through great clusters of these aërolites. It has been estimated that not less than a hundred thousand million of them are annually



A SHOWER OF BRILLIANT METEORS ON THE OCEAN.

caught by our atmosphere; and when we consider the comparative smallness of the ring which we traverse, we can see that the absolute number of the meteorites belonging to our system must be something incomparably exceeding human calculation.

In the immediate neighborhood of the sun, where his attraction exercises the most direct and potent influence, they will be found in special abundance; and it is to the fact of their existence that we must look for an explanation of the corona, and perhaps of yet greater and more interesting mysteries of our system. The corona is simply the sunlight reflected from their surfaces, as it is from the disks of the moon and planets. For a vast distance round the sun the whole firmament is powdered with them as thick as hailstones, and the reflection from them produces a continuous luminous glow, lost indeed in the overpowering brightness of ordinary sunlight, but shining out with exquisite lustre when his direct beams are cut off from us.

Splendors of the Aurora

OF all optical phenomena, the aurora borealis, or the northern daybreak, is one of the most striking, especially in the regions where its full glory is revealed. It fires the sky above the horizon with shooting jets of flame.

What fills with dazzling beams the illumined air?
What wakes the flames that light the firmament?
The lightnings flash: there is bright splendor there,
And earth and heaven with fiery sheets are blent;
The winter's night now gleams with brighter, lovelier ray,
Than ever yet adorned the golden summer's day.

The appearances exhibited by the aurora are so various and wonderful. A cloud, or haze, is commonly seen in the northern region of the heavens, but often bearing towards the east or west, assuming the form of an arc, seldom attaining a greater altitude than forty degrees, but varying in extent from five to one hundred degrees. The upper edge of the cloud is luminous, sometimes brilliant and irregular. The lower part is frequently dark and thick, with the clear sky appearing between it and the horizon. Streams of light shoot up in columnar forms from the upper part of the cloud, now extending but a few degrees, then as far as the zenith, and even beyond it.

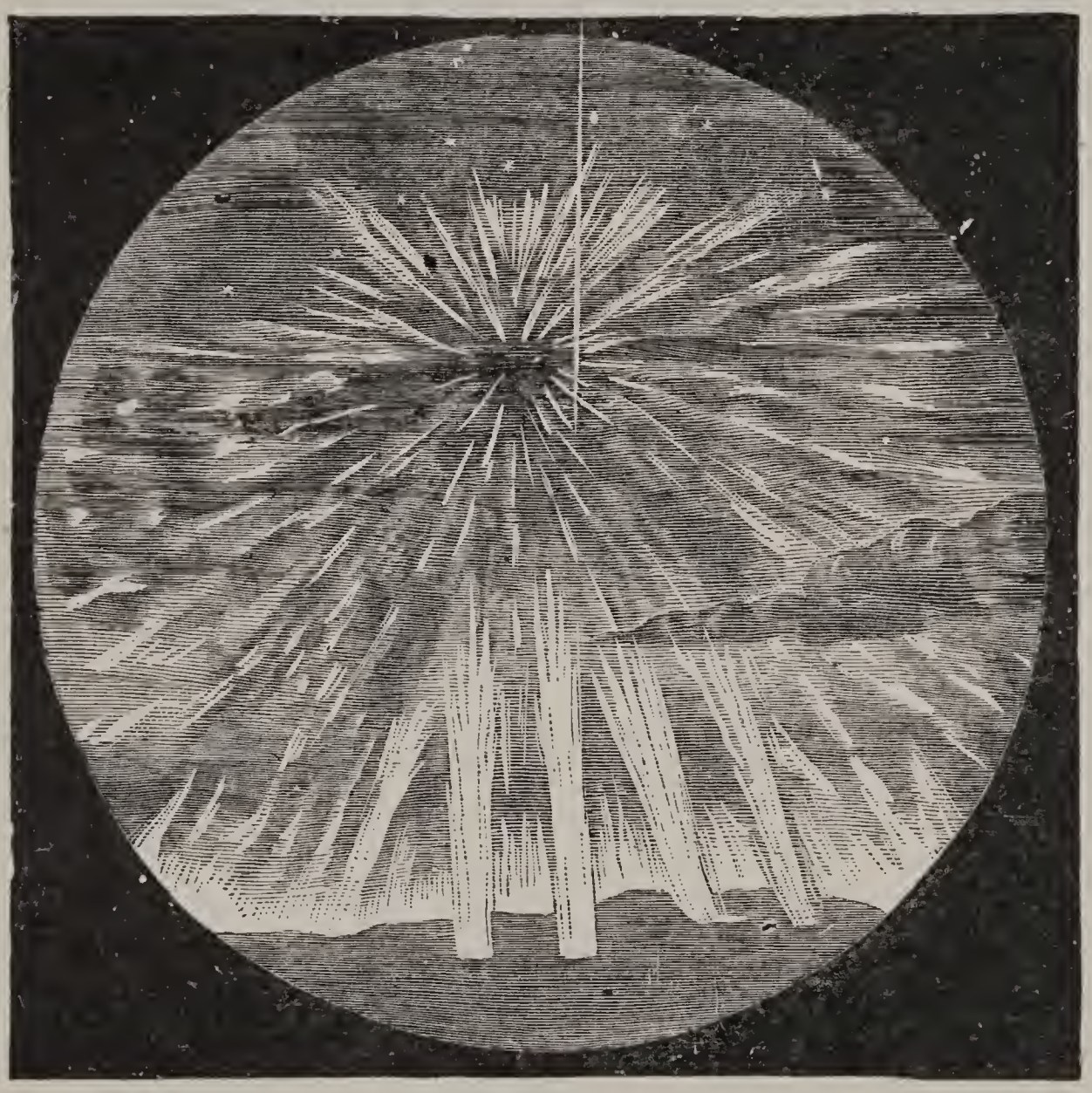
Instances occur in which the whole hemisphere is covered with these coruscations; but the brilliancy is the greatest, and the light the strongest, in the north, near the main body of the meteor. The streamers have in general a tremulous motion, and when close together present the appearance of waves, or sheets of light, following each other in rapid succession. But no rule obtains with reference to these streaks, which have acquired the name of "the merry dancers," from their volatility, becoming more quick in their motions in stormy weather, as if sympathizing with the wildness of the blast. Such is the extraordinary aspect they present, that it is not surprising the rude Indians should gaze upon them as the spirits of their fathers roaming through the land of souls. They are variously white, pale red, or of a deep blood color, and sometimes the appearance of the whole rainbow as to hue is presented.

Vivid Illumination.

When several streamers emerging from different points unite at the zenith, a small and dense meteor is formed, which seems to burn with greater violence than the separate parts, and glows with a green, blue, or purple light. The display is over sometimes in a few minutes, or continues for hours, or through the whole night, and appears for several nights in succession. Captain Beechey remarked a sudden illumination to occur at

one extremity of the auroral arch, the light passing along the belt with a tremulous, hesitating movement towards the opposite end, exhibiting the colors of the rainbow; and as an illustration of this appearance, he refers to that presented by the rays of some molluscous animals in motion.

Captain Parry notices the same effect as a common one with the aurora, and compares



AURORAL FLAMES IN THE NORTHERN SKY.

it, as far as its motion is concerned, to a person holding a long ribbon by one end, and giving it an undulatory movement through its whole length, though its general position remains the same. Captain Sabine likewise speaks of the arch being bent into convolutions, resembling those of a snake in motion. Both Parry, Franklin and Beechey agree that no streamers were ever noticed shooting downwards from the arch.

The preceding statement refers to aurora in high northern latitudes, where the full magnificence of the phenomenon is displayed. It forms a fine compensation for the long and dreary night to which these regions are subject, the gay and varying aspect of the heavens contrasting refreshingly with the repelling and monotonous appearance of the earth. We have already stated that the direction in which the aurora generally makes its first appearance, or the quarter in which the arch formed by this meteor is usually seen, is to the northward.

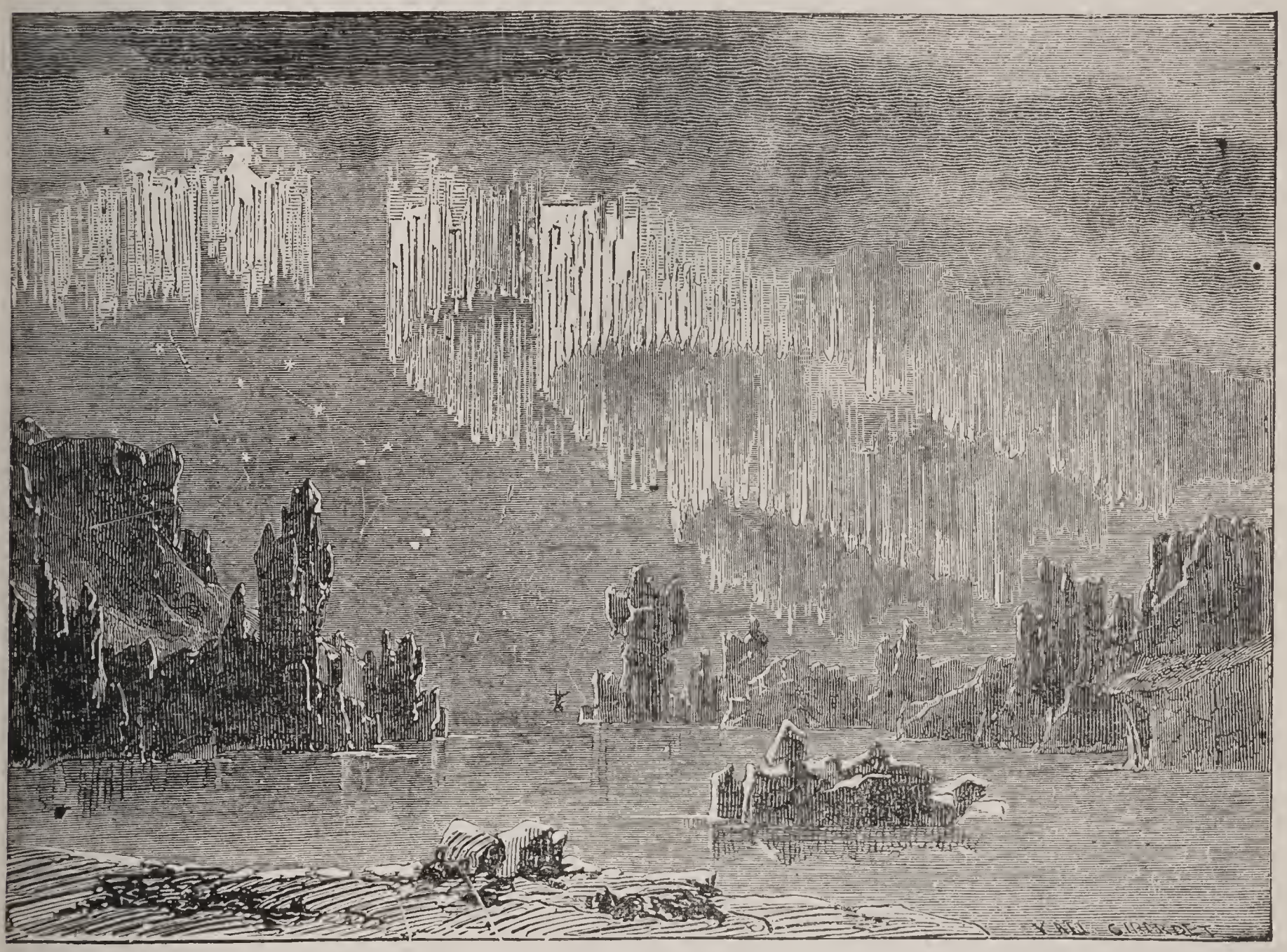
Effulgent Arch.

But this does not hold good of very high latitudes, for by the expeditions which have wintered in the ice, it was almost always seen to the southward; while, by Captain Beechey, in the "Blossom," in Kotzerne Sound, two hundred and fifty miles to the southward of the ice, it was always observed in a northern direction.

Dalton has furnished the following account of an aurora, as observed by him: Attention was first excited by a remarkably red appearance of the clouds to the south, which afforded sufficient light to read by at eight o'clock in the evening, though there was no moon nor light in the north. From half-past nine to ten there was a large, luminous, horizontal arch to the southward, and several faint concentric arches northward. It was particularly noticed that all the arches seemed

exactly bisected by the plain of the magnetic meridian.

At half-past ten o'clock streamers appeared, very low in the southeast, running to and fro from west to east. They increased in number, and began to approach the zenith, apparently with an accelerated velocity, when all on a sudden the whole hemisphere was covered with them, and exhibited such an



BRILLIANT AURORA BOREALIS IN THE ARCTIC SEAS.

appearance as surpasses all description.

The intensity of the light, and prodigious number and volatility of the beams, the grand intermixture of all the prismatic colors in their utmost splendor, variegating the glowing canopy with the most luxuriant and enchanting scenery, afforded an awful, but at the same time the most pleasing and sublime spectacle in nature. Every one gazed with astonishment, but the uncommon grandeur of the scene only lasted one minute. The variety of colors disappeared, and the beams lost their lateral motion, and were converted into the flashing radiations.

The great distinction between the polar countries and the other regions of the globe, is their long day and long night. Describing an immense spiral around the horizon, the sun gradually mounts to the highest point of his course; then, in the same manner, it returns towards the horizon, and bids farewell to the earth, slowly dying away in a gloomy and ghastly twilight. And, for six months, the Arctic wildernesses knew it not.

When the navigator, says Captain Parry, finds himself buried for the first time in the silent shadows of the polar night, he cannot

conquer an involuntary emotion of dread; he feels transported out of the sphere of ordinary existence. These deadly and sombre deserts seem like those uncreated voids which Milton has placed between the realms of life and death. The very animals are affected by the melancholy which veils the face of nature. Under the influence of the almost perpetual gloominess Dr. Kane's Newfoundland dogs went mad, and died.

Dazzling Radiance.

But if the sun for six months of the year deprives the circumpolar countries of the splendor of its fires, an imposing phenomenon frequently illuminates the long nights with dazzling radiance, as if nature sought to compensate for the absence of the orb of day by the most impressive of all her optical wonders. The polar nights are nearly always lighted up by the gorgeous lustre of the aurora; called borealis or australis, according to the poles at which it is produced. Shafts and rays of light shoot upwards to the zenith. These luminous sheaves pass through all the colors of the rainbow; from violet and sapphire to green and purple-red. Sometimes the columns of light issue from the resplendent arch mixed with blackish rays; sometimes they rise simultaneously at different points of the horizon, and unite to form a sea of flame pervaded by rapid undulations. On other occasions, fiery dazzling standards are unfurled to float lightly in the air. A kind of canopy of soft and tranquil light, which is known as the corona, announces the close of the phenomenon. Thereupon the luminous shafts begin to wane in splendor, the richly colored arcs dissolve, die out, and soon of all the magnificent spectacle nothing remains but a whitish cloudy haze.

The arch of the aurora is only part of a ring of light, which is elevated considerably above the surface of our globe, and whose centre is situated in the vicinity of the pole. It is easy, then, to account for the different aspects it presents to observers placed at different angles to it. A person some degrees south of the ring would necessarily see only a very small arc of it towards the north, from the interposition of the earth between him and the observer; if he stood nearer the north, the arc would appear larger and higher; if immediately below it, he would see it apparently traversing the zenith; or if within the ring, and still further north, he would suppose it to culminate in the south. It is supposed that the centre of the ring corresponds with the magnetic north point, in the island of Boothia Felix.

Magnetic Needle Affected.

The phenomenon generally lasts several hours, and is frequently diversified by peculiar features; so that sometimes it seems to present the hemispherical segment of a gigantic wheel; sometimes it waves and droops like a rich tapestry of colored light, in a thousand prismatic folds; and, at other times, it may be compared to a succession of resplendent banners, or streamers, waving in the dark and intense sky.

The arch varies in elevation, but is seldom found more than ninety miles above the terrestrial surface. Its diameter must be enormous, for it has been known to extend from Italy to the polar regions, and has been simultaneously visible in Sardinia, Connecticut, and New Orleans.

Of the magneto-electric origin of the aurora no doubt can be entertained. When it occurs, the magnetic needle is invariably affected, the very noticeable perturbation being greatest at the climax of the auroral brilliancy.

PHENOMENA OF LIGHT

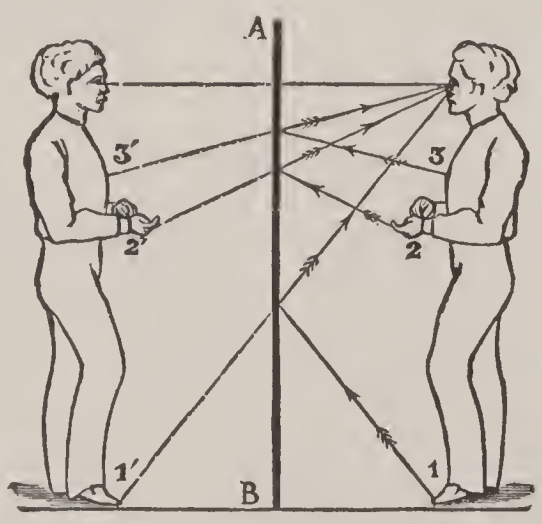
SUBSTANCES which are not sources of light have the power to reflect it from their surfaces when it falls on them. Thus glass is a very good reflector; and the still surface of water is also exceedingly good in this respect, so that as you walk along the bank of a river its surface may appear like pearl by reflecting the white light of the clouds, and its margin greener than the emerald in mirroring the grassy slopes of the bank on the other side.

We are now in a position to consider the formation of the image in a large looking-glass. The observer standing on the right receives borrowed light proceeding from the points 1, 2 and 3 (see figure), which is again reflected from the surface of the glass into his eye. As a result the observer perceives his very image at each of the three points 1, 2 and 3, appearing behind the glass at 1′, 2′ and 3′, and the same with all the points between and around which make up the object and image.

A Curious Effect of Reflection.

If you take this book and turn any of its pages towards a looking-glass, you will find, upon attempting to read the reflected print, that you cannot do so at all. The word MAGIC, for example, appears as if it were reversed; and so with any other word, for they look just as they would if we could take each word and turn it completely over around one end as centre. This phenomenon is known as *lateral inversion*, and you really see it when you look at your image in a looking-glass, for the left side of your face appears really as the right side in the looking-glass, and so on.

You would have to travel now for many a day to find an educated person who believes in ghosts. Time was, however, when you would have to travel quite as long to find some one who did not believe in them.

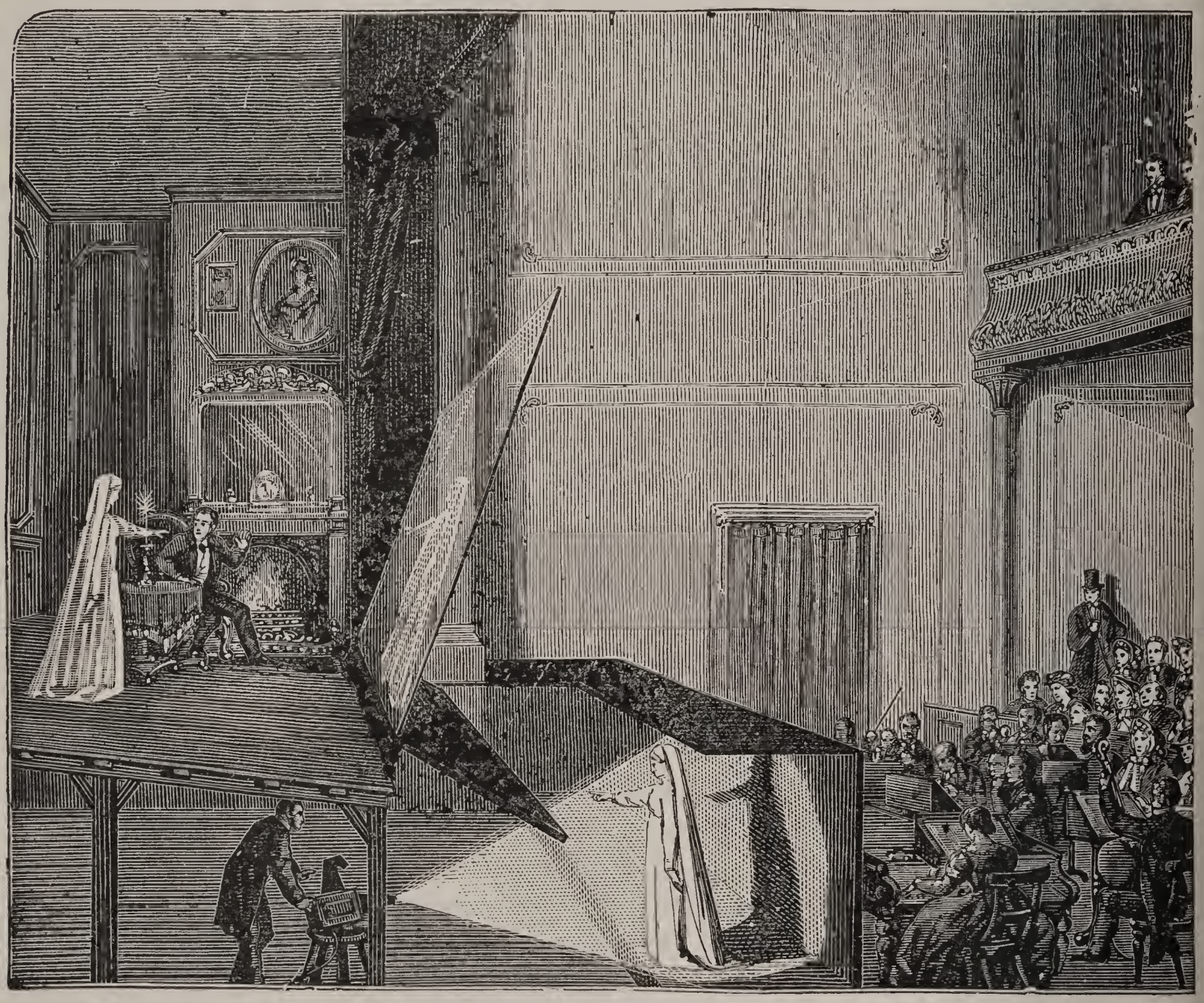


HOW YOU SEE YOURSELF IN A MIRROR.

There could then be found people who had seen them, so they thought, with their own eyes, and therefore were as much convinced of their reality as Hamlet was when he saw the ghost of his father at Elsinore. The belief still exists in unfrequented nooks—places where advanced ideas are a long time in reaching—and it exists alongside with a belief in witchcraft and such like nonsense. When a ghost appears nowadays, an investigation—not always of the gentlest kind—has generally shown that the sheeted spectre has been made of solid flesh, much too solid

to vanish or permit of a stout cudgel passing through it. By universal consent, then, ghosts are now relegated to the stage. How real they appear there probably every lad is aware, for has he not seen them in white flowing robes, walking along and speaking, and exhibiting the ghostly attribute of permitting a performer to run his sword through them without their being in the least affected? For many a day after he has doubtless wondered how the thing was done, and has at last given it up in despair, while all the time the explanation was to be had without stepping out of doors even, so very easy to understand are some of these things.

Often, when you have stood gazing out of the window in the evening, you have seen, as if outside, a lamp or gas-jet, but the exact picture of the light within the room. The *ghost* of the light, it is plain at once to see, results from the transparent pane of glass just opposite you acting as a reflector. Pepper's famous ghost is produced just in the same way.



THE FAMOUS PEPPER GHOST.

A large plate of transparent glass on the stage faces the audience, being inclined at an angle of 45°. Below this the actor stands in a pit, with a strong light falling on him. The audience cannot see him, but his image as reflected from the glass is very ap-

parent, and seems to be on the stage and somewhere behind the transparent reflector, so that in gazing steadfastly at the ghost you fail to perceive the glass which produces it. Ghosts produced in this way are often shown, but you will have no difficulty in detecting the large plate of glass on the stage now that your attention is directed to it.

Long-Distance Signals.

Often during the campaigns in Zululand, Afghanistan and Cuba a peculiar mode of transmitting news was adopted when the telegraph lines had been cut by the enemy, or where no telegraph lines had been erected. The plan is so exceedingly simple that you will understand it at once. You have often noticed that the window-panes of houses miles away have looked like burnished gold; it has happened at such times that they were so placed with reference to the sun and yourself that the light from the great luminary has been reflected from them straight in your direction. A single bit of looking-glass placed in the same plane as these windows would have acted just in the same way.

Now suppose you have a comrade on a distant hill, with a piece of looking-glass so placed that the light of the sun or moon is sent in your direction, you could see the flare a great many miles away, and each time he brought his cap before it the bright point would disappear. If, therefore, you have arranged with your friend that a certain number of times of taking his cap away from the mirror—that is, of producing a given number of flashes—shall mean a certain thing, he is able to communicate with you; and if you have a mirror too, you may communicate with him, and so hold a conversation.

Often in this way has one camp flashed news to another over the heads of their common enemies, and the line of communication could not be cut, as would have been the case had the two camps been connected by ordinary telegraph. Here, then, we see one of the most elementary principles in Physics employed for a very important purpose.

Many a time in thoughtful mood you will have watched the dancing shadows formed by the flickering firelight, and perchance, as your own shadow has suddenly appeared on the wall behind you, you have given a start at its giant size and extraordinary form. You can readily perceive the cause of such a shadow, which is briefly this—that light from the fire travelling in straight lines cannot pass round corners to any marked extent, so that when an object stands in its way all behind it is in darkness, and the form of this area of darkness will vary with each movement. Hence, from the same object employed as a light obstructor a wonderful variety of shadow-forms may be produced, and perhaps in nothing is this so remarkably shown as in hand-shadows.

Singular Shadow-Pictures.

In the accompanying cut you have a variety of hand-shadows with the particular disposition of the hands which is required to produce them. Other forms of hand-shadows you will doubtless find out as you are practicing these, and they will afford many a half-hour's amusement as you lead out your shadow-animals, including the bear and the goat, the dog and the pig, and a host of others.

We need scarely give any directions as to their production, for, if the gas-light be, say, in the middle of the room, and you want to cast the hand-shadows on a particular wall,

the hands are brought between the gas-light and the wall, and their distance from the former is regulated according to your wish as to the size of shadow you want. We may add that you will be able easily to represent the jaws of your hand-shadows moving by bringing together and separating the parts which give rise to the shadow of the mouth. Moreover, if you are able to imitate the sounds of any of the beasts whose hand-shadows you can form—as, for example, the bark of the dog, the bray of the donkey, and the lowing of the cow—your entertainment becomes complete.



HAND-SHADOWS OF ANIMALS.

COMPARATIVE Face Reading . PHYSIOGNOMY

THE study of character and its indications is as old as human inquiry, and therefore the tendency of mind in this direction must arise from a special mental trait. The changing expression of the face is everywhere regarded as a mirror in which the passing thought or present emotion can be seen.

If one be long afflicted by grief or blessed by joy, wearied by trouble or vexed with care, shadowed with melancholy or excited by wit, inspired by faith or led by conscience, inflated by pride or subjected to its domination, the emotions awakened by these different states and revealed in the face, may become so far fixed as to defy concealment. But let one's circumstances be suddenly changed; let grief be turned to joy, and trouble, care, and vexation will fade from the countenance and leave scarcely a trace.

Then there are expressions of face inherited from joyous or sorrowing parentage. In the same family one child absorbs the sunshine of its mother's joy, and it glows from its face for a lifetime; another, if circumstances have changed, will wear the tear marks, or the expression of bitterness that darkened the mother's life; and no doubt the brain as well as the face will bear a similar and even more permanent record.

The very attitudes and motions assume, by long habit, an expression of the inner life. One accustomed to the exercise of authority gets a stiffer spine, a more exalted head, and firmer lines of the face, and the brain conforms in development and activity to the conditions that have become habitual.

For centuries the face has been studied, and attempts have been made to reduce the face to a science with greater or less approaches to success. People will study the face and its expression and be influenced by it without having any science or rules for it, or any means of explaining it. Yet their impressions will be correct.

Likeness Between Men and Animals.

It is interesting to note the very striking facial resemblance between men and some of the animals, as shown in the accompanying engravings. The animal world appears to have been created on one general plan, and types of face and features among the lower orders are constantly reproduced among the higher.

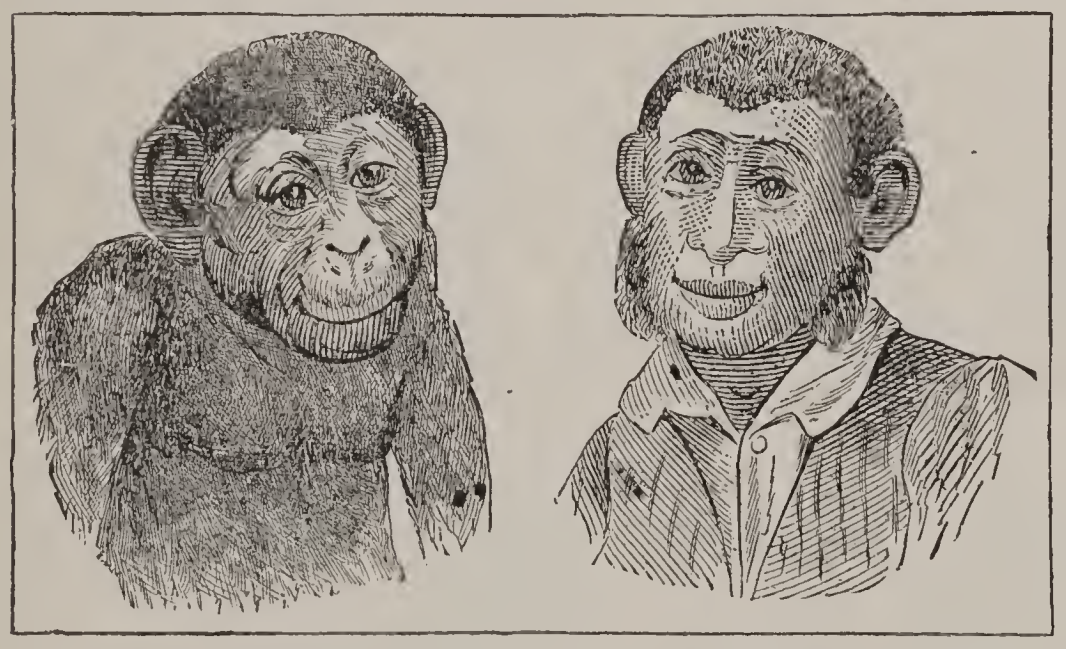
Near the close of the last century the physiology of the brain became the subject of special investigation by an eminent physician of Germany, Dr. Gall, and he claimed that he had discovered signs of character in the brain, that it can be safely studied as the basis of character, and that whatever the face or attitudes or motions may reveal, the impulse comes from the brain. His mode of investigation has acquired the name of Phrenology.

For nearly a hundred years the term Phrenology has been before the world, and has been understood to relate to the laws and activities of the human mind, and that in some way it is related to the brain as its organ. A few have studied Phrenology and accepted it heartily; others have made it a topic for contempt or ridicule, and, though thousands of the general public have little or no knowledge on the subject, other thousands have more or less information respecting it, and, so for as they understand it, they believe and accept it.



A STRIKING PAIR.

A brief outline of the doctrines of Phrenology may here be made:



APE. APISH.

First. The brain is the organ or instrument of the mind, just as the eye is the instrument of sight. Every trait of character, every talent, propensity, or sentiment has its organ.

There is a general belief that somehow the *intellect* stands related to the brain, and when an injury to any part of that viscus occurs, the newspapers will say that the intellect was, or was not, affected by the injury. But a doubt exists whether the brain is also the seat of the feelings and the propensities.

To say that some injury of the brain did not affect the intellect, is about as definite as it would be to say that a man was injured in the head, but that his eye-sight, or his smelling power, or his hearing was not affected, and therefore eye-sight and hearing do not necessarily belong to the head; but Phrenology teaches that every sentiment, every element of taste and aversion, of hope and fear, of love and hatred, as well as the *intellectual faculties* and *memory*, have their special seats in some part of the brain.

Second. The mind is not a single power, but has many faculties, some of which may be stronger or weaker than the others in the same person; from which arises the great variety of character.



"PUSS, YOU REMIND ME OF ——."

Third. Each faculty or propensity of the mind has its special organ in the brain.

Fourth. Size of brain, the quality being good, is the true measure of its power. The



OWL. OWLISH.

brain, when deficient in size or low in quality or health, is always connected with a low degree of mental power. Even among the lower animals the brain is found to be large and complicated in proportion to the variety and strength of their faculties.

Fifth. There are several groups of faculties, and each of these groups is represented by organs located together in the brain. The organs of the intellect are situated in the forehead in what are called the *anterior lobes* of the brain; those of the social nature in the back head, or *posterior lobes* of the brain; those of passion, appetite, and self-preservation, in the side head, or *middle lobes* of the brain; while those organs which manifest aspiration, pride, ambition, are in the crown of the head, and those of sentiment, sympathy, morality and religion in the top head.

Sixth. Each faculty of the mind, each sentiment and propensity, has its own organs, as each function of the body has its specific organ. If this were not so, each person would manifest the same amount of talent or power on all subjects, such as arithmetic, language, music, mechanism, the power of reasoning, love of property, courage, prudence or pride. Everybody knows that persons rarely ever show equal talent on all topics, and that a man may be a genius at one thing and find it impossible, by long training, to become even tolerably successful in other things. If the mind were a single power and the brain a single organ this would not be the case.

The senses of seeing, hearing, tasting, smelling, are not always possessed by each person in an equal degree of perfection, these several powers being dependent on different organs, and each related to a special part of the brain; so the mental faculties and dispositions are alike unequal in a given person, owing to the greater strength or weakness of their respective organs in the brain; hence some people represent partial genius, others partial idiocy or partial insanity, and these facts are explained and sustained only by the phrenological theory of the mind.



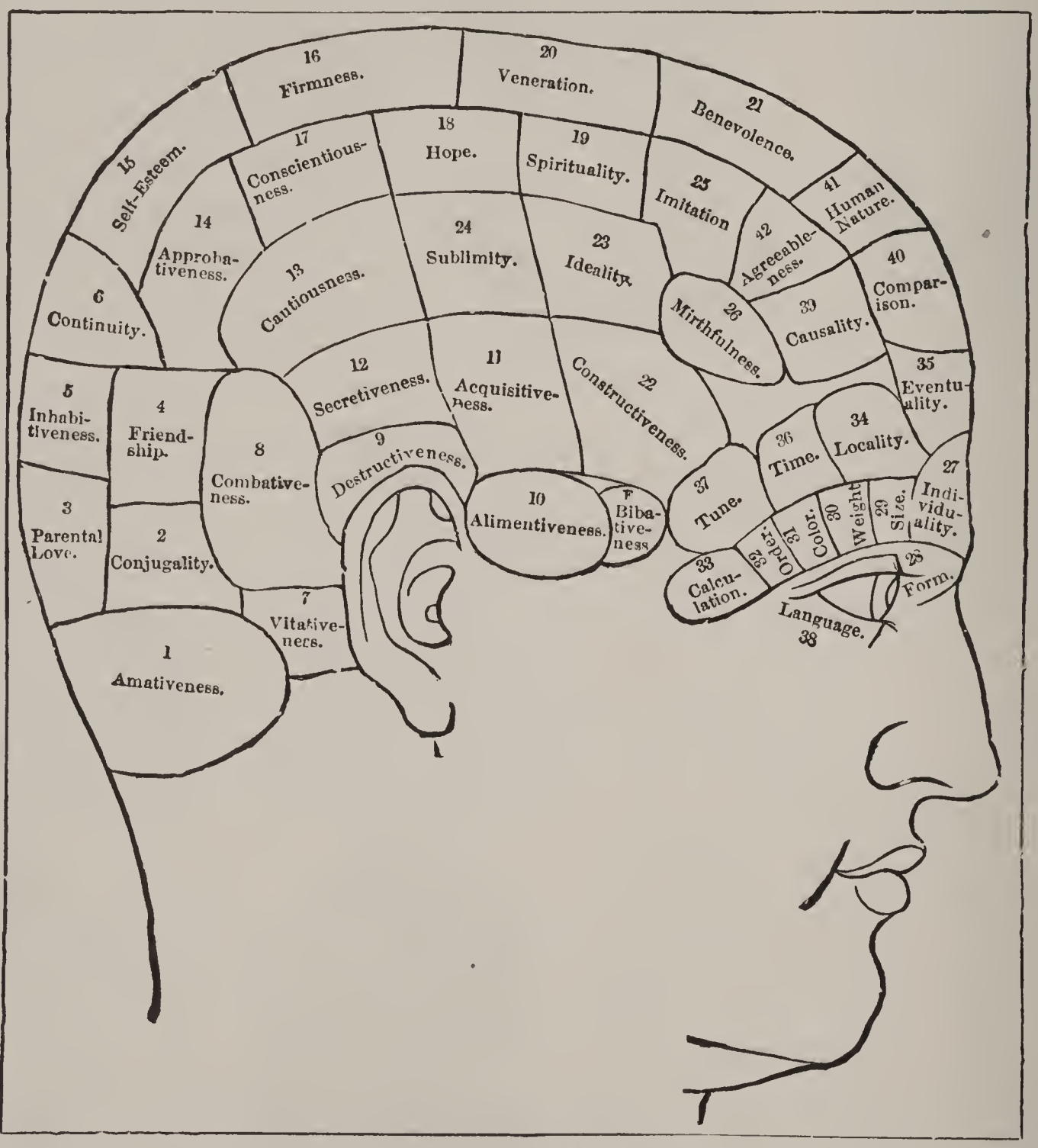
MARKED RESEMBLANCE.

Seventh. The Quality and Temperament of the organization determine of the degree of vigor, activity and endurance of the mental powers.

Temperament is indicated by external signs, including the build, complexion and texture. Men recognize different qualities in their judgment of horses, cattle and other stock, although they do not use the terms we apply to mankind. Men who deal in timber know that the quality of different kinds of wood has infinite variety; the spongy palmetto of the South, the soft texture of the willow, or the coarse character of the hemlock in contrast with oak, hickory, ebony, lignum vitæ, showing that contrasts of temperament or quality in wood are various.

To a critical phrenologist and physiognomist as wide a range of quality may be found in the human race. Speed, activity, strength, endurance in birds and horses are recognized and understood. The trim, compact game-chicken that weighs five pounds finds little difficulty in vanquishing the clumsy, coarse and tall Shanghai or Chittagong that may turn the scales at fourteen pounds; and temperament is a term which, rightly understood, explains the reason of these peculiarities.

A practical knowledge of Phrenology is considered by many persons of great assistance in deciding what occupation a young man or woman should follow.



LOCATION AND DESCRIPTION OF THE ORGANS AS FIXED BY PHRENOLOGISTS.

CURIOUS FACTS

THINGS NOT GENERALLY KNOWN

ALPS, THE.—These mountains comprise about 180 peaks, from 4,000 to 15,732 feet high, the latter being the height of Mont Blanc, the highest spot in Europe. The summit is a sharp ridge, like the roof of a house, consisting of nearly vertical granite rocks. The ascent of these awful solitudes is most perilous, owing to the narrow paths, tremendous ravines, icy barriers, precipices, etc.

In many places every step has to be cut in the ice, the party being tied to each other by ropes, so that if one slips he may be held up by the rest, and silence is enforced, lest the noise of talking should dislodge the avalanches of the Aiguille du Midi. The view from the mountain is inexpressibly grand.

On the Alps, the limit of the vine is an elevation of 1,600 feet; below 1,000 feet, figs, oranges and olives are produced. The limit of the oak is 3,800 feet, of the chestnut 2,800 feet, of the pine 6,500 feet, of heaths and furze to 8,700 and 9,700 feet, and perpetual snow exists at an elevation of 8,200 feet.

ALCOHOL—WHO DRINKS IT?—It has been the endeavor of the census-takers, in 1890, to obtain, as far as possible, such facts as relate to the use of *alcohol as a beverage*. It appears that alcohol, as such (in some cases diluted with water, but without any coloring or extraneous flavoring), is used by a certain foreign element of our population. It is drunk to a great extent by Poles, Norwegians, Swedes, Finns, Hungarians and Russians. The quantity thus consumed is larger than is generally supposed.

Inquiry of some of the large houses in the Northwest, familiar with this particular trade, elicits the information that fully one-half of the alcohol sold in that section is drunk, it being the favorite beverage of these foreign races. It is estimated, by competent authority, that about fifteen barrels of alcohol are daily consumed for that purpose in New York city alone. A considerable amount is consumed by the same element in the coal regions of Pennsylvania, and undoubtedly in other localities.

BODY, THE HUMAN.—The average height of a newly-born infant is 18 inches: average weight. 6.77 lbs. The average weight of the newly-born male child is 7⅓ lbs., of the female child 6⅔ lbs. It takes 3 years for the child to grow the second 18 inches, so as to be 3 feet high.

Average weight of adult male, 145 lbs.; height, 5 ft. 7 inches; chest measurement of male, 36 inches; drawing strength between hands, 75 lbs.

The skeleton is one inch shorter than the measurement of the living person—skeleton weighs about 14 lbs.—there are 240 bones. The body contains about 12 lbs. of blood; about 6⅓ ozs. pass through the heart in each beat, and in adults from 65 to 75 beats occur per minute. All this passes through the lungs and is revivified by the oxygen of the air—as bright red blood goes by the subdivision of the arteries to every minutest portion of the body, and returns laden with impurities as dark venous blood through the veins to the heart again.

The heart is a little larger than the fist, and weighs about 9 to 11 ozs.

The adult male brain weighs 49 to 50 ozs., female 44 to 45 ozs.; the nerves of motion and sensation from every portion of the body end in the brain and spinal cord.

The lungs consist of about 174 million sacs or cells at the end of minute tubes that unite to form larger tubes, and these form the two bronchial tubes, and these unite in the windpipe, opening into the mouth and nose. At each breath the lungs are filled with air, the purpose of which is to oxygenate the blood. The blood absorbs about 30 ozs. of oxygen per day, sufficient to consume in the tissues of the body the carbon from about 3 lbs. of bread. The utmost amount of air expirable at one breath is calculated at 200 to 250 cubic inches.

The stomach lies beneath the lungs, near the centre of the body, and is a sac of a capacity of about a pint (without distension), in which the food is changed by the digestive juices and ferments.

The liver, to the right, and beneath the stomach, weighs 50 to 60 ozs.; it changes the starch of foods to sugar, secretes bile, and otherwise aids in digestion.

Spleen, to left of stomach, about the size of fist, weighs 5 to 7 ozs.; functions undetermined.

The intestines, about 34 feet in length; the digestion of the food and the absorption of its nutrient qualities into the lacteals and the blood is completed in the intestines.

The two kidneys weigh each about 4½ ozs.; about 2,000 ozs. of blood passes through them in an hour, and by them the waste fluid portions of the food not useful to the blood are strained out. The waste fluids of the body are also exuded through the pores of the skin. The area of the surface of the body is about 2,500 square inches, it contains about 7,000,000 pores, each about ¼ of an inch long, or a total length of nearly 28 miles of pores.

The secretions of the body, saliva, gastric juice, chyle, bile etc., which are absorbed from the blood and reabsorbed by it in twenty-four hours, amount to 25 lbs. Adults require eight or nine hours' sleep.

CALLED OVER THE COALS.—Originally "hauled over the coals," derived from the ordeal by fire in early days, one form of which consisted in making the accused walk over burning coals. This method of persuasion was often employed to get money from Jews by the kings and barons of early centuries.

CITIES, FICTITIOUS NAMES OF.—Aberdeen, Scotland, Granite City.

Alexandria, Egypt, Delta City.

Alton, Ill., Tusselburgh.

Akron, O., Summit City.

Baltimore, Md., Monumental City.

Birmingham, O., Bran Town.

Boston, Mass., Puritan City; Modern Athens; Hub of the Universe; City of Notions; Athens of America; The Hub.

Brooklyn, N. Y., City of Churches.

Buffalo, N. Y., Queen City of the Lakes.

Cairo, City of Victory.

Cincinnati, O., Queen City; Porkopolis; Queen of the West; Paris of America.

Chicago, Ill., Garden City.

Cleveland, Forest City.

Dayton, O., Gem City of Ohio.

Detroit, Mich., City of the Straits.

Duluth, Minn., Zenith City.

Edinburgh, Scotland, Maiden Town; Northern Athens; Modern Athens; Athens of the North.

Gibraltar, Key to the Mediterranean.

Hannibal, Mo., Bluff City.

Havana, Cuba, Pearl of the Antilles.

Holyoke, Mass., Paper City.

Indianapolis, Ind., Railroad City.

Jerusalem, Palestine, City of Peace; City of the Great King.

Kansas City, Mo., Mushroomopolis.

Keokuk, Ia., Gate City.

Lafayette, Ind., Star City.

Limerick, Ireland, City of the Violated Treaty.

Lowell, Mass., City of Spindles; Manchester of America.

London, England, City of Masts; Modern Babylon.

Louisville, Ky., Falls City.

Madison, Wis., Lake City.

Milan, Italy, Little Paris.

Milwaukee, Wis., Cream City.

Minneapolis, Minn., City of Flour.

Nashville, Tenn., City of Rocks.

New Haven, Conn., City of Elms.

New Orleans, La., Crescent City.

New York, Gotham; Empire City; Metropolitan City.

Pekin, Ill., Celestial City.

Philadelphia, Pa., Quaker City; City of Brotherly Love; City of Homes.

Pittsburg, Pa., Iron City; Smoky City; Birmingham of America.

Portland, Me., Forest City.

Paterson, N. Y., Lyons of America.

Peoria, Ill., Whisky Town.

Quebec, Canada, Gibraltar of America.

Quincy, Ill., Gem City.

Racine, Wis., Belle City.

Rome, Italy, Eternal City; Nameless City; Queen of Cities; Seven-Hilled City; Mistress of the World.

Rochester, N. Y., Flour City.

St. Louis, Mo., Mound City.

St. Paul, Minn., Gem City.

San Francisco, Cal., Golden City.

Salem, Mass., City of Peace.

Salt Lake City, City of the Saints.

Springfield, Ill., Flower City.

Streator, Ill., City of the Woods.

Toledo, O., Corn City.

Venice, Italy, Bride of the Sea.

Washington, D. C., City of Magnificent Distances.

Winnipeg, Manitoba, Gate City of the Northwest.

DIXIE.—An imaginary place, somewhere in the Southern States of America, celebrated in a popular negro melody as a perfect paradise of luxurious ease and enjoyment. The term is often used as a collective designation of the Southern States.

EARTH'S CENTRE.—All bodies weigh less the further removed they are from the centre of the earth. A block of stone weighing 700 pounds upon the seashore, will weigh only 699 pounds if carried up a mountain three miles high. A pendulum oscillates more quickly at the poles than at the equator, because the earth is flatter by twenty-six miles at the poles—that is, the "bob" of the pendulum is that much nearer the earth's center, and therefore heavier, and so swings more quickly.

EL DORADO (*Spanish, the golden land.*)—A name given by the Spaniards to an imaginary country, supposed, in the sixteenth century, to be situated in the interior of South America, between the rivers Orinoco and Amazon, and to abound in gold and all manner of precious stones. Expeditions were fitted out for the purpose of discovering this fabulous region; and, though all such attempts proved abortive, the rumors of its existence continued to be believed down to the beginning of the eighteenth century.

"FLYING DUTCHMAN."—The name given by sailors to a spectral ship, which is supposed to cruise in storms off the Cape of Good Hope, and the sight of which is considered the worst of all possible omens. She is distinguished from earthly vessels by bearing a press of sail when all others are unable, from stress of weather, to show an inch of canvas. The cause of her wanderings is variously explained. According to one account, a Dutch captain, bound home from the Indies, met with long continued head-winds and heavy weather off the Cape of Good Hope, and refused to put back, as he was advised to do, swearing a very profane oath that he would beat round the cape if he had to beat there until the day of Judgment. He was taken at his word, and doomed to beat against head-winds all his days. His sails are believed to have become thin and sere, his ship-sides white with age, and himself and crew reduced almost to shadows. He cannot heave to or lower a boat, but sometimes hails vessels through his trumpet, and requests them to take letters home for him. The superstitution has its origin, probably, in the looming, or apparent suspension in the air, of some ship out of sight—a phenomenon sometimes witnessed at sea, and caused by unequal refraction in the lower strata of the atmosphere.

"GOLDEN AGE" AND "IRON AGE."—The Elizabethan was the *Golden Age* of England, the Victorian is the *Iron Age*, the *Silver Age* was the reign of Queen Anne. The first named period was noted for giants of literature, simplicity of manners, integrity of conduct, honesty of intention, and domestic virtues. The second is an age of commerce and hard matter-of-fact. The third was noted for elegant refinement, delicacy of speech, luxurious living, politeness, and artificial manners.

"GO TO HALIFAX."—Halifax law was, that the criminal should be "condemned first, and inquired upon after." Halifax also has the credit of inventing the rude guillotine of Maunaye, and easily became a place of terror to rogues. In the United States it is now used as a coarse expletive, Halifax, *i. e.*, Hell.

HOBSON'S CHOICE.—Tobias Hobson was the first in England who let out hackney horses. To each who applied, Hobson obliged him to take the horse which stood nearest the stable-door, hence the modern "Hobson's choice," meaning practically none. "Neck or nothing" commonly added was probably "Next or nothing."

JOHN BULL.—This nickname is derived from the satire of Dr. Arbuthnot, representing the Englishman under that name as a bluff, kind-hearted and bull-headed farmer. In the minds of some it is associated with Dr. John Bull, organist to Queen Elizabeth, and a celebrated musician.

"KICK THE BUCKET."—This term, meaning to die, alludes to the way in which a slaughtered pig is held up. The ends of a bent piece of wood, technically called a "bucket," are fastened behind the tendons of the hind legs in order to suspend the carcass. It has sometimes been said to have originated from a method of committing suicide by standing on a bucket, adjusting the noose and then kicking the bucket away.

LIBERTY BELL.—The order for the bell was given in 1751. The State House of Pennsylvania, in Philadelphia, work on which had been suspended for a number of years, was then approaching com-

THE OLD LIBERTY BELL.

pletion. The lower floors were already occupied by the Supreme Court in the chamber, while in the other assembled the Freemen of the Province of Pennsylvania, then consisting of one body. A committee was appointed by the Freemen, with Peter Norris as chairman, and empowered to have a new bell cast for the building. The commission for the

bell was in the same year awarded to Robert Charles, of London, the specification being that the bell should weigh about 2000 pounds and cost £100 sterling.

It was to be made by the best workmen, to be examined carefully before being shipped, and to contain, in well-shaped letters around it the inscription: "By order of the Province of Pennsylvania, for the State House in the City of Philadelphia, 1752." An order was given to place underneath this the fatal and prophetic words from Leviticus xxv. 10: "Proclaim liberty throughout all the land, unto all the inhabitants thereof."

The reason for the selection of this text has been a subject of much conjecture, but the true reason is apparent when the full text is read. It is as follows: "And ye shall hallow the fiftieth year and proclaim liberty throughout the land and to all the inhabitants thereof." In selecting the text the good Quakers had in memory the arrival of William Penn and their forefathers more than half a century before.

In August, 1752, the bell arrived, but though in apparent good order, it was cracked by a stroke of the clapper while being tested. It could not be sent back, as the captain of the vessel who had brought it over could not take it on board. Two skillful men undertook to recast the bell, which, on being opened, revealed a bell which pleased very much. But it was also found to be defective. The original bell was considered too high, and a quantity of copper was added to the composition, but too much copper was added. There were a great many witticisms on account of the second failure, and the ingenious workmen undertook to recast the bell, which they successfully did, and it was placed in position in June, 1753.

On Monday the 8th of July (not the 4th), at noon, true to its motto, it rang out the memorable message of "Liberty throughout the land and to all the inhabitants thereof."

For fifty years the bell continued to be rung on every festival and anniversary until it eventually cracked. This happened in July, 1835, when it was tolling for the death of Chief Justice John Marshall.

An ineffectual attempt was made to cause it to continue serviceable by enlarging the cause of its dissonance and chipping the edges. It was removed from its position in the tower to a lower story, and only used on occasions of public sorrow, such as the death of ex-Presidents and statesmen. Subsequently it was placed on the original timbers in the vestibule of the State House, and in 1873 it was suspended in a prominent position immediately beneath where a larger bell presented to the city in 1866 now proclaims the passing hours.

MAN IN THE MOON.—A name popularly given to the dark lines and spots upon the surface of the moon, which are visible to the naked eye, and which when examined with a good telescope, are discovered to be the shadows of lunar mountains. It is one of the most popular, and perhaps one of the most ancient superstitions in the world, that these lines and spots are the figure of a man leaning on a fork, on which he carries a bundle of thorns or brushwood, for stealing which on a Sunday he was confined in the moon. The account given in Numbers xv. 32 of a man who was stoned to death for gathering sticks upon the Sabbath-day, is undoubtedly the origin of this belief.

MONROE DOCTRINE.—In 1822, during the Presidency of James Monroe, the Spanish-American colonies having fought their way to independence as against Spain, they were recognized as an independent power by the United States. In his annual message to Congress in 1823, the President proclaimed the celebrated doctrine of non-interferance as follows: "That as a principle the American continents, by the free and independent position which they have assumed and maintained, are henceforth not to be considered as subjects of future colonization by any European power." This doctrine is attributed to Adams, who was Secretary of State under Monroe.

LEGAL FORMS

A HAND-BOOK OF LAW

THE following compilation of business law contains the essence of a large amount of legal verbiage: 1. If a note is lost or stolen, it does not release the maker; he must pay it, if the consideration for which it was given and the amount can be proven.

2. Notes bear interest only when so stated.

3. Principals are responsible for the acts of their agents.

4. Each individual in a partnership is responsible for the whole amount of the debts of the firm, except in cases of *special partnership*.

5. Ignorance of the law excuses no one.

6. The law compels no one to do impossibilities.

7. An agreement without consideration is void.

8 A note made on Sunday is void.

9. Contracts made on Sunday cannot be enforced.

10. A note by a minor is voidable. A contract made by a minor is void.

11. A contract made by a lunatic is void.

12. A note obtained by fraud, or from a person in a state of intoxication, cannot be collected.

13. It is a fraud to conceal a fraud.

14. Signatures made with a lead-pencil are good in law.

15. A receipt for money is not always conclusive.

16. The acts of one partner bind all the rest.

17. The maker of an "accommodation" bill or note (one for which he has received no consideration, having lent his name or credit for the accommodation of the holder) is not bound to the person accommodated, but is bound to all other parties, precisely as if there was a good consideration.

18. No consideration is sufficient in law if it be *illegal* in its nature.

19. Checks or drafts must be presented for payment without unreasonable delay.

20. Checks or drafts should be presented during business hours; but in this country, except in the case of banks, the time extends through the day and evening.

21. If the drawee of a check or draft has changed his residence, the holder must use due and reasonable diligence to find him.

22. If one who holds a check, as payee or otherwise, transfers it to another, he has a right to insist that the check be presented that day, or, at farthest, on the day following.

23. A note indorsed in blank (the name of the indorser only written) is transferable by delivery, the same as if made payable to bearer.

24. If time of payment of a note is not named, it is payable on demand.

25. The time of payment of a note must not depend upon a contingency. The promise must be absolute.

26. A bill may be written upon any kind of paper, either with ink or pencil.

27. The payee should be named in the note, unless it is payable to bearer.

28. An indorsee has a right of action against all whose names were on the bill when he received it.

29 If the letter containing a protest of non-payment be put into the post-office, any miscarriage does not affect the party giving notice. Notice of protest may be sent either to the place of business or of residence of the party notified.

30. The holder of a note may give notice of protest either to all the previous indorsers or only to one of them; in case of the latter he must select the last indorser, and the last must give notice to the last before him, and so on. Each indorser must send notice the same day or the day following. Neither Sunday nor any legal holiday is counted in reckoning time in which notice is to be given.

31. The loss of a note is not sufficient excuse for not giving notice of protest.

32. If two or more persons, as partners, are justly liable on a note or bill, due notice to one of them is sufficient.

33. If a note or bill is transferred as security, or even as payment of a pre-existing debt, the debt revives if the note or bill be dishonored.

34. An indorsement may be written on the face or back.

35. An indorser may prevent his own liability to be sued by writing "without recourse" or similar words.

36. An oral agreement must be proved by evidence.

A written agreement proves itself. The law prefers written to oral evidence, because of its precision.

37. No evidence can be introduced to *contradict* or *vary* a written contract; but it may be received in order to explain it, when such explanation is needed.

38. Written instruments are to be construed and interpreted by the law according to the simple, customary and natural meaning of the words used.

39. The finder of negotiable paper, as of all other property, must make reasonable efforts to find the owner, before he is entitled to appropriate it for his own purposes. If the finder conceal it, he is liable to the charge of larceny or theft.

40. Joint payees of a bill or note, who are not partners, must all join in an indorsement.

41. One may make a note payable to his own order and indorse it in blank. He must write his name across its back or face, the same as any other indorser.

42. After the death of a holder of a bill or note, his executor or administrator may transfer it by his indorsement.

43. The husband who acquires a right to a bill or note which was given to the wife, either before or after marriage, may indorse it.

44. "Acceptance" applies to bills and not to notes. It is an engagement on the part of the person on whom the bill is drawn to pay it according to its tenor. The usual way is to write across the face of the bill the word "accepted."

45. An account outlawed according to statute of state where it is contracted cannot be collected unless judgment note has been given.

Business Agreements

AN agreement or contract is an arrangement entered into by two or more persons, by which each binds himself to perform certain specified acts within a designated time.

Agreements may be verbal, but it is better in all cases, and absolutely essential in matters of importance, to express them in writing.

Fraud annuls all contracts and obligations, and the party so wronged is relieved of his obligation by law. If both the parties to an agreement act fraudulently, neither can take advantage of the fraud of the other; nor can one who acts fraudulently set his own fraud aside for his benefit.

Agreements should be prepared and signed in duplicate, triplicate, etc., according to the number of persons concerned in them. Each party should have a copy, and should carefully preserve it.

General Form of Agreement.

THIS AGREEMENT, made this twenty-fifth day of September, in the year of our Lord one thousand eight hundred and ninety—, between John Swan, of Livonia, County of Livingston, State of New York, party of the first part, and Hiram Bolt, of the same place, party of the second part,

WITNESSETH, That the said John Swan, party of the first part, hereby covenants and agrees, that he will deliver to the said Hiram Bolt, party of the second part, during the month of September, one hundred cords of hickory wood, at the woodyard of the said Hiram Bolt, as follows: twenty cords to be delivered on or before the 10th of October; twenty cords more to be delivered on or before the 15th of October; twenty cords more on or before the 20th of October; twenty cords more on or before the 25th of October, and the remaining twenty cords on or before the 30th of October; the entire quantity of one hundred cords to be delivered by the 30th of October.

And the said Hiram Bolt, party of the second part, in consideration of the prompt fulfilment of this agreement by the said John Swan, party of the first part, agrees and binds himself to pay to the said John Swan, the sum of three dollars for each and every cord of hickory wood delivered to him by the said John Swan or his agents, and to pay for each cord of wood as soon as it is delivered at his woodyard.

In case of the failure of either party to this contract to make good his promises, it is hereby stipulated and agreed that the party so failing shall forfeit to the other party the sum of one hundred dollars in cash as fixed and settled damages.

IN WITNESS WHEREOF, the parties to these presents have hereunto set their hands and seals the day and year first above written.

JOHN SWAN. [SEAL.]
HIRAM BOLT. [SEAL.]

Signed, sealed and delivered in presence of

Laws of Partnership

A PARTNERSHIP is an agreement between two or more persons for joining together their money, goods, labor, and skill, or any or all of them, in some lawful commerce or business, under an understanding, express or implied from the nature of the undertaking, that the parties to the agreement shall share between them the profits and loss arising therefrom.

It is not necessary that each partner should contribute an equal amount of money to be entitled to an equal share of the profits. An individual may contribute his knowledge of the business to be engaged in, or his skill, or his labor, or all three, the other partner or partners contributing a specified sum of money, or the money and their services. The agreement must state exactly what is contributed.

The act of one partner binds all the others. Thus, if one partner gives a negotiable note for the use of the firm, and signs it with his individual name, such signature binds all the other partners.

A person who contributes his money to the capital of a firm and shares its profits, without allowing his name to be used, is termed a secret or silent partner. A person contributing to the capital and sharing the profits of the concern, but taking no active part in its management, is termed a sleeping or dormant partner. Both of these are liable to creditors for the debts of the concern, even though they did not know them to be members of the firm.

In forming partnerships, it is generally the rule to form them for a stated period, which must be expressed in the agreement. This is termed a limited partnership, and expires "by limitation" at the end of the period named.

A Partnership Agreement.

THIS AGREEMENT, made this tenth day of June, 189–, between James Smith, of Salem, Washington County, N. Y., of the one part, and Henry Smythe, of the same place, of the other part, witnesseth:

The said parties agree to associate themselves as co-partners, for a period of five years from this date, in the business of buying and selling hardware and such other goods and commodities as belong in that line of trade; the name and style of the firm to be "Smith & Smythe."

For the purpose of conducting the business of the aboved named partnership, James Smith has, at the date of this writing, invested Five Thousand Dollars, as capital stock, and the said Henry Smythe has paid in the like sum of Five Thousand Dollars, both of which amounts are to be expended and used in common, for the mutual advantage of the parties hereto, in the management of their business.

It is further agreed that once every year, or oftener, should either party desire, a full, just and accurate exhibit shall be made to each other, or to their executors, administrators or representatives, of the losses, receipts, profits and increase made by reason of, or arising from, such co-partnership. And after such exhibit is made, the surplus profit, if such there be, resulting from the business, shall be divided between the subscribing partners, share and share alike.

[*Here state amount to be drawn out annually by each party.*]

It is also agreed that in case of a misunderstanding arising with the partners hereto which cannot be settled between themselves, such difference of opinion shall be settled by arbitration, upon the following conditions, to wit: Each party to choose one arbitrator, which two thus elected shall choose a third; the three thus chosen to determine the merits of the case, and arrange the basis of a settlement.

IN WITNESS WHEREOF, The undersigned hereto set their hands the day and year first above written.

JAMES SMITH.
HENRY SMYTHE.

Signed in presence of
JOHN JONES,
SAMUEL BROWN.

Deeds

IN this country, no lands can be transferred excepting by a deed, which must be properly signed, sealed, witnessed, acknowledged, delivered, and recorded. In some of the States, seals are not necessary to the validity of a deed.

A deed must be delivered in order to render it valid. There is no special form necessary to constitute a proper delivery. If the deed comes into the possession of the grantee with the knowledge and consent of the grantor, however it may have been gotten possession of, it is a valid delivery. If a man makes a deed and fails to deliver it, and dies with it in his possession, the deed is of no effect whatever. A deed to a married woman may be delivered either to her or to her husband.

A deed must be recorded to be valid. That is, the grantee must deliver it to the Recorder of Deeds, or other official appointed by law for that purpose, who must cause it to be copied in full in a book kept in his office for that purpose. A deed is regarded as recorded from the moment it is placed in the hands of this officer, and he generally writes upon it the year, month, day, hour, and minute when he received it.

Warranty Deed with Covenants.

THIS INDENTURE, Made this eighteenth day of March, in the year of our Lord 189–, between Ben Cooper, of Ramsey, County of Fayette, State of Illinois, and Mary, his wife, of the first part, and L. Y. Rood, of the same place, of the second part.

WITNESSETH, That the said party of the first part, for and in consideration of the sum of Three Thousand Dollars in hand, paid by the said party of the second part, the receipt whereof is hereby acknowledged, have granted, bargained, and sold, and by these presents do grant, bargain and sell, unto the said party of the second part, his heirs and assigns, all the following described lot, piece, or parcel of land, situated in the town of Ramsey, in the County of Fayette, and State of Illinois, to wit:

[*Here describe the property.*]

Together with all and singular the hereditaments and appurtenances thereunto belonging or in any wise appertaining, and the reversion and reversions, remainder and remainders, rents, issues, and profits thereof; and all the estate, right, title, interest, claim and demand whatsoever, of the said party of the first part, either in law or equity, of, in, and to the above bargained premises, with the hereditaments and appurtenances: To have and to hold the said premises above bargained and described, with the appurtenances, unto the said party of the second part, his heirs and assigns, forever. And the said Ben Cooper, and Mary, his wife, parties of the first part, hereby expressly waive, release and relinquish unto the said party of the second part, his heirs, executors, administrators, and assigns, all right, title, claim, interest, and benefit whatever, in and to the above described premises, and each and every part thereof, which is given by or results from all laws of this State pertaining to the exemption of homesteads.

And the said Ben Cooper and Mary Cooper, his wife, party of the first part, for themselves and their heirs, executors, and administrators, do covenant, grant, bargain, and agree, to and with the said party of the second part, his heirs and assigns, that at the time of the ensealing and delivery of these presents they were well seized of the premises above conveyed, as of a good, sure, perfect, absolute, and indefeasible estate of inheritance in law, and in fee simple, and have good right, full power, and lawful authority to grant, bargain, sell, and convey the same, in manner and form aforesaid, and that the same are free and clear from all former and other grants, bargains, sales, liens, taxes, assessments, and encumbrances of what kind or nature soever, and the above bargained premises in the quiet and peaceable possession of the said party of the second part, his heirs and assigns against all and every person or persons lawfully claiming or to claim the whole or any part thereof, the said party of the first part shall and will warrant and forever defend.

In testimony whereof, the said parties of the first part have hereunto set their hands and seals the day and year first above written.

BEN COOPER. [SEAL.]
MARY COOPER. [SEAL.]

Mortgages

A MORTGAGE is a deed conveying real estate to a creditor, as security for a debt. It conveys the property to him as fully and absolutely as though it were sold outright, with this difference, that the debtor retains by the terms of the deed the right to pay the debt and redeem the property within a specified time.

It is usual for the mortgage to contain an agreement that the mortgagor shall keep the premises insured in a certain sum for the benefit of the mortgagee. Where no such stipulation is made, and the mortgagee insures the premises, he cannot recover the cost of the insurance from the mortgagor.

Should a mortgagor erect buildings upon mortgaged land, the mortgagee, on taking possession, becomes the owner of these buildings also. If, however, the mortgagee erects buildings upon lands on which he holds a mortgage, the mortgagor, upon redeeming the land, becomes the owner of such buildings without paying the mortgagee for them. Such matters may, and should always, be regulated by an agreement between the parties.

Real Estate Mortgage to Secure Payment of Money.

THIS INDENTURE, Made this nineteenth day of October, in the year of our Lord, 189–, between W. H. Harrison, of Urbana, County of Champaign, and State of Illinois, and Helen, his wife, party of the first part, and Robert Fairchild, party of the second part.

WHEREAS, The said party of the first part is justly indebted to the said party of the second part, in the sum of Four Thousand Dollars, secured to be paid by two certain promissory notes (bearing even date herewith), the one due and payable at the First National Bank at Champaign, Ill., with interest, on the nineteenth day of October, in the year 189–; the other due and payable at the First National Bank at Champaign, Ill., with interest, on the nineteenth day of October, 189–.

NOW, THEREFORE, THIS INDENTURE WITNESSETH, That the said party of the first part, for the better securing the payment of the money aforesaid, with interest thereon, according to the tenor and effect of the said two promissory notes above mentioned; and, also, in consideration of the further sum of one dollar to them in hand paid by the said party of the second part, at the delivery of these presents, the receipt whereof is hereby acknowledged, have granted, bargained, sold, and conveyed, and by these presents do grant, bargain, sell, and convey, unto the said party of the second part, his heirs and assigns, forever, all that certain parcel of land, situate, etc.

[*Describing the premises.*]

To have and to hold the same, together with all and singular the tenements, hereditaments, privileges, and appurtenances thereunto belonging or in any wise appertaining. And also, all the estate, interest, and claim whatsoever, in law as well as in equity, which the party of the first part have in and to the premises hereby conveyed unto the said party of the second part, his heirs and assigns, and to their only proper use, benefit, and behoof. And the said W. H. Harrison, and Helen, his wife, party of the first part, hereby expressly waive, relinquish, release, and convey unto the said party of the second part, his heirs, executors, administrators, and assigns, all right, title, claim, interest, and benefit whatever, in and to the above described premises, and each and every part thereof, which is given by or results from all laws of this State pertaining to the exemption of homesteads.

PROVIDED ALWAYS, and these presents are upon this express condition, that if the said party of the first part, their heirs, executors, or administrators, shall well and truly pay, or cause to be paid, to the said party of the second part, his heirs, executors, administrators, or assigns, the aforesaid sums of money, with such interest thereon, at the time and in the manner specified in the above mentioned promissory notes, according to the true intent and meaning thereof, then, in that case, these presents and everything herein expressed, shall be absolutely null and void.

IN WITNESS WHEREOF, the said party of the first part hereunto set their hands and seals the day and year first above written.

W. H. HARRISON. [L. S.]
HELEN HARRISON. [L. S.]

Landlords and Tenants

LEASES should be written. No particular form of words is essential, but the lease should state in the clearest manner the terms and conditions of the agreement, so that nothing may be left to dispute between the landlord and tenant. The law does not recognize verbal promises as binding. Therefore the lease must state explicitly all the covenants between the parties.

When the landlord desires to prevent his tenant from sub-letting a part or the whole of the premises, he must provide for it in the lease. A person holding a lease which does not contain this prohibition can sub-let at his pleasure.

The lease should definitely state the period for which it is given. If no time is specified the tenant can hold the property for one year, but no longer. A tenant-at-will cannot vacate the property without giving notice of his intention, nor can he be put out without being given notice of the landlord's desire to regain possession of the property. The laws in the various States are quite uniform as to the time of notice required. If the rent be payable quarterly, three months' notice must be given. If it be payable at more frequent periods, then the notice must equal in length the period of the payment. If the rent is payable monthly, a month's notice is sufficient; if weekly, a week's notice will answer.

A lease given for a specified time, as one year, expires at the end of that time, and the tenant may leave without giving notice, or the landlord may put him out without notice.

A lease should be recorded, whether the law requires it or not. Such record binds a subsequent purchaser of the property to assume all the obligations of the former landlord as expressed in the lease, and is a necessary legal form.

Form of Lease of a Farm and Buildings.

THIS AGREEMENT, Made this first day of January, 189–, between Peleg Ross, of Shawnee County, State of Kansas, party of the first part, and O. B. Scott, of the county and State aforesaid, party of the second part,

WITNESSETH, That the said Peleg Ross lets, and the said O. B. Scott agrees to take and hold of him as tenant all that parcel of land, with the buildings and improvements appertaining and belonging to it, situate—

[*Here insert an accurate and careful description of the property.*]

From the first day of February next ensuing, upon the terms following, that is to say:

Said tenant shall be deemed a tenant from year to year;

That said tenant enter and take possession of said premises on the first day of February next;

That either party may determine the tenancy by a notice in writing, three months before the expiration of any year from the first day of February next preceding;

That the rent of said premises shall be five hundred dollars per annum, payable in half yearly payments on, etc., and on, etc.;

That the said tenant agrees to cause the following repairs to be made, viz.: [*Here state the repairs agreed upon*];

That said tenant on quitting the farm shall receive such pecuniary compensation for improvements in fencing, etc., as two arbitrators (one of which arbitrators shall be nominated by each party, and if either neglect to nominate his arbitrator, the other party may nominate both arbitrators) shall award, which arbitrators shall abate according to the benefit derived by the tenant from such repairs, improvements, and additions, and take into consideration how far, at the expiration of the tenancy, they may be beneficial to the estate.

IN WITNESS WHEREOF, The said parties have hereunto set their hands and seals the day and year first above written.

PELEG ROSS. [SEAL.]
O. B. SCOTT. [SEAL.]

Last Wills and Testaments

ANY one may make a will who is of legal age and sound mind. A married woman cannot, however, make a will unless the law of the State in which her property is situated vests her with the separate ownership of it.

The legal age for making a will devising real estate is twenty-one years. In most of the States a male, aged eighteen years, or a female, aged sixteen years, may bequeath personal property by will.

The person making a will, if a male, is called the testator; if a female, the testatrix.

A will is of no effect during the life of the maker, and may be set aside, altered or replaced by a new will, at any time previous to the death of the maker.

The *last will* made annuls all previous wills. It is, therefore, the duty of the testator to state distinctly in the first part that this is his last will. If he has made other wills, he should state that by this instrument he revokes all other wills.

The will should close with a formal statement that it is the deliberate act of the testator, and that it is properly signed and sealed by him.

All wills must be witnessed. This is a very important part of making a will, and should be performed in strict accordance with the laws of the State in which it is made. Some of the States require two, and some three credible witnesses. It is a good plan for the testator to have the will witnessed by *three* persons, in all cases, whether the law requires it or not.

The witnesses to a will should *see* the testator sign it. He should perform the act in their presence. If the testator cannot write, or is too feeble by reason of old age or sickness to do so, he may make his mark in the presence of the witnesses.

Where a will is made, and the testator subsequently disposes of any or all the property described in the will, the will is invalidated to the extent of the alienation of the property.

Where a man makes a will, and subsequently marries and has children, the law regards the will as revoked, unless the testator, after such acts, makes a new will confirming the original one.

A person cannot be an executor to a will if at the time of the probate of the will he is a minor, a drunkard, a convict, or of unsound mind.

Wills are of two kinds, written and verbal or nuncupative.

A codicil is an addition to a will designed to modify or add new provisions to a will. It does not revoke the will. Though there can be but one will, there may be any number of codicils.

A will made by a single woman is revoked by her subsequent marriage. By the terms of her marriage settlement she may, however, provide for the right to dispose of her property.

A wife cannot be deprived of her dower by any will of her husband. A husband may, however, bequeath to his wife a certain sum in lieu of her dower.

General Form of Will.

I, Thomas Henry Howard, of the City of Baltimore, State of Maryland, declare this to be my last will and testament.

1. I give and bequeath to my wife, Catharine Howard, all the fixtures, prints, books, paintings, linen, china, household goods, furniture, chattels, and effects, other than money, or securities for money, which shall, at my death, be in or about my

house, No. 458 Park avenue, in the said City of Baltimore.

2. I also give and bequeath unto my said wife, the sum of fifty thousand dollars in the preferred stock of the Baltimore & Ohio Railroad Company, now held by me.

3. I give and devise to my son, George Frederick Howard, his heirs and assigns, forever, all that certain brick dwelling and lot of ground, known as Number 529, in St. Paul street, in the said City of Baltimore, together with all the hereditaments and appurtenances thereto belonging, or in anywise appertaining; to have and to hold the premises above described to the said George Frederick Howard, his heirs and assigns, forever.

4. I give and bequeath to my said son, George Frederick Howard, the sum of one hundred thousand dollars, in the bonds of the United States of America, known as the five-twenty bonds, being all the securities of the United States now held by me.

5. I also bequeath to each of my domestic servants who may be living with me at the time of my death, the sum of two hundred dollars.

6. All the rest, residue, and remainder of my real and personal estate, I give, devise, and bequeath in equal shares, to my said wife, Catharine Howard, and to my son, George Frederick Howard, their heirs and assigns forever.

7. I appoint my said son and my said friend, Alfred W. Lee, executors of this my will, and desire that they shall not be required to give any security for the performance of their duties.

IN WITNESS WHEREOF, I, Thomas Henry Howard, have hereunto set my hand and seal this twenty-fifth day of May, 189–.

THOMAS HENRY HOWARD. [SEAL.]

ENCYCLOPEDIA
OF
VALUABLE INFORMATION

Curiosities of the Bible.

The Bible contains 3,566,480 letters, 773,746 words 31,173 verses, 1,189 chapters, and 66 books. The word "and" occurs 46,277 times. The word "Lord" occurs 1,855 times. The word "reverend" occurs but once, which is in the 9th verse of the 111th Psalm. The middle verse is the 8th verse of the 118th Psalm. The 21st verse of the 7th chapter of Ezra contains all the letters of the alphabet except the letter J. The 19th chapter of II Kings and the 37th chapter of Isaiah are alike. The longest verse is the 9th verse of the 8th chapter of Esther. The shortest verse is the 35th verse of the 11th chapter of St. John. There are no words or names of more than six syllables. In the original Hebrew manuscripts of the Old Testament a division of the matter into paragraphs was early introduced for the convenience in reading. Larger divisions into sections suitable for Sabbath readings were made about the middle of the fifteenth century. The gospels were divided into sections for a similar purpose as early as the third century. The present arrangement of the Scriptures into chapters, however, originated in the thirteenth century with Cardinal Hugo, who devised it while making a Latin concordance. The division into verses was introduced by the celebrated printer, Robert Stephens, in his Greek Testament (1551), and in his Latin Bible (1556–7).

Originals of the New Testament.

The New Testament was originally written in Greek. It is not claimed that any of the manuscripts written by the Apostles themselves are in existence.

The Bible Printed in 300 Tongues.

The British and Foreign Bible Society reports that the sacred Scriptures were last year translated into six fresh languages. The number of tongues in which this society now publishes the Bible is thus increased to 300. Fifty years ago it was published in 150 tongues. The society distributed four million two hundred and six thousand volumes during the year.

Valuable Bibles.

A copy of the Mazarin Bible was recently sold at auction in London, and brought an even $10,000. This is the fourth of these volumes which has been sold inside of sixteen years, and the price it brought was also lower than those of the other three. One sold for $19,500, another for $13,450, and the other for $13,250. This edition of the Bible was the work of Gutenberg and Faust, and was the first book ever printed with movable types. As an artistic production, it is claimed to have never been surpassed.

The Roman Catholic Bible.

The translations of the Bible by the Protestants at the Reformation was soon followed by translation at the hands of Roman Catholic scholars, intended for those who still adhered to the Roman Church. Accordingly the New Testament appeared at Rheims, in France, in 1582; and the Old Testament appeared at Douai in 1609–10, although it had been prepared before the New Testament. The first complete edition of the entire Bible, according to this recension was published at Rouen in 1633–35. Says Dr. Schaff: "Its translators were good scholars, but were obliged to take the Latin Vulgate as the basis, and to adhere closely to it." A revision was made about the middle of the last century.

Discoveries and Settling of Countries.

America discovered by Columbus, October 11, 1492.

Andreanoffsy Isles, between Asia and America, discovered 1760.

Angola settled by Portugal, 1482.

Anguilla, in the Caribbees, first planted by England, 1650.

Antigua settled by the English, 1632.

Archangel, passage to, discovered, 1553.

Aruba Isle, planted by Holland, 1634.

Azores Isles discovered by Portugal, 1419.

Baffin's Bay discovered, 1622.

Bahama Isles, discovered, 1659; taken possession of by the English, December, 1718.

Barbadoes discovered and planted, 1614.

Barbuda Isle first planted by England, 1628.

Barrington Isle one of the Gallapagos, explored, June, 1793.

Batavia, in the Island of Java, first fortified by Holland, 1618.

Bermuda Isles discovered, 1527; settled, 1612.

Boston, Mass., built, 1630.

Botany Bay settlement first sailed from England, March 21, 1787.

Bourbon (formerly Mascareen) Isle planted by France, 1672.

Brazil discovered, 1486; settled by the Spaniards, 1515; settled by Holland, 1624; taken from Holland by Portugal, 1654.

Britain discovered to be an island about 90.

Caledonia, in America, settled, 1699.

California discovered by Cortez, 1543.

Canada discovered by Cabot, 1499; explored by the French, 1508, 1524 and 1534; settled, 1540; Quebec built, 1603; taken first by England, 1628.

Canary Isles discovered, 1344, and granted Spain; explored, 1393.

Cape Blanco, on the coast of Africa, discovered, 1441.

Cape Breton discovered by the English, 1584; yielded to France, 1632; taken by England, 1745; restored, 1748; again taken and kept, 1758.

Cape de Verd Islands discovered, 1447.

Cape of Good Hope discovered, 1487; planted by Holland, 1651.

Cape Horn first sailed round, 1616.

Carolina discovered, 1497, planted, 1629.

Caribbee Isles discovered, 1595.

Cat Isle, one of the Bahamas, the first discovery in America by Columbus, 1492.

Cayenne Isle first planted by France, 1635.

Ceylon, the Isle of, discovered, 1506.

Chatham Isle, one of the Gallapagos, explored, June, 1793.

Chili discovered by Spain, 1518; invaded by the Spaniards, 1540.

China first visited by the Portuguese, 1517; conquered by the Eastern Tartars, 1635.

Christopher's, St., Isle of, discovered, 1595; settled by the English, 1626.

Congou Kingdom discovered, 1482; settled by Portugal, 1486.

Crimea settled by Russia, 1784.

Cuba discovered, 1492; settled in 1511.

Curacoa settled by the Dutch, 1634.

Darien settled, 1700.

Davis' Straits discovered, 1586.

De la Plate, river, discovered, 1512.

Descada Isle was discovered by Columbus, 1494.

Domingo, St., Isle of, discovered, 1492; city founded, 1494.

Dominica discovered by Columbus, November 3, 1493.

Easter Isle discovered, 1722.

East Indies discovered by the Portuguese, 1497; visited overland by some English, 1591; first Dutch voyage, 1595; first voyage of the English company, 1601; first from France, 1601; first voyage of the Danes, 1612.

Faulkland, Isles of, discovered, 1592.

Florida discovered by Cabot, 1500; settled in 1763.

Frobisher's Straits discovered, 1578.

Fox Island, in North Pacific Ocean, discovered 1760.

Galapagos Isles discovered, 1700; explored by Captain James Colnett, 1793.

Georgia colony erected by General Oglethorpe, 1739.

Goree Isle, on the Guinea Coast, first planted by the Dutch, 1617.

Granada Isle settled by France, 1652.

Greenland was discovered in 1585; settled, 1721, 1731.

Guadaloupe Isle discovered by Columbus, 1493; planted by France, 1635.

Guinea Coast discovered by the Portuguese, 1482; slave trade commenced here by Captain Hawkins an Englishman, 1563.

Helena, St., discovered, 1502; first possessed by England, 1600; settled by the English, 1651.

Hood's Isle, one of the Galapagos, in the Pacific Ocean, explored, June, 1793.

Hudson Bay discovered by Captain Hudson, 1607.

Iceland discovered by a Danish pirate in 860.

Jamaica discovered by Columbus, 1494; settled by the Spaniards, 1509.

Japan discovered, 1542; visited by the English, 1612.

Kamtschatka discovered by the Russians, 1739.

Ladrone Isles discovered, 1521.

Le Roach Island, near Faulkland's Island, discovered, 1657.

Louisiana, west of the Mississippi, discovered by the French, 1633; settled by them, 1718; ceded to the United States, 1801.

Madagascar discovered by the Portuguese, 1506.

Madeira, Island of, discovered, 1344 and 1418.

Magellan, Straits of, discovered, 1520.

Marigalante Isle discovered, 1493.

Maryland planted by Lord Baltimore, at the expense of £40,000, 1633.

Mauritius Isle discovered, 1598; settled in 1721.

Mexico conquered by the Spaniards under Cortez, 1519-21.

Montreal discovered, 1534; settled, 1629.

Montserrat, in the West Indies, discovered by Columbus, 1493; planted by England, 1632.

Nevis planted by England, 1628.

New Caledonia discovered, 1774.

New England planted by the Puritans, 1620.

Newfoundland discovered by Cabot, 1497; settled, 1614.

New Guinea discovered, 1699.

New Holland discovered by the Dutch, 1627; settled by the English, 1787.

New Jersey planted by the Swedes, 1637.

New Spain or Mexico, discovered, 1518.

New Zealand discovered, 1660; explored in 1769.

New Plymouth built and settled, 1620.

New York settled, 1664.

North-East passage to Russia discovered, 1553.

Nova Scotia settled, 1622.

Nova Zembla discovered, 1553.

Otaheite, or George III's Island, discovered June 18, 1765.

Owhy-he Island discovered, 1778; where Captain Cook was killed.

Palmyra, ruins of in the Deserts of Syria, discovered, 1678.

Panama settled, 1516.

Paraguay discovered, 1525.

Pennsylvania, Penn's charter for planting, 1680.

Peru discovered, 1518.

Philippine Isles discovered by the Spaniards, 1521.

Pitt's Straits in the West Indies, discovered, April 30, 1760.

Porto Rico discovered, 1497.

Saba planted by the Dutch, 1640.

Salem, Mass., settled, 1628.

Sandwich Islands, in the Pacific Ocean, discovered, 1778.

Savannah settled, 1732.

Sierra Leone Coast discovered, 1460.

Society Isles, in the Pacific Ocean, discovered, 1765.

Solomon Isles, in America, discovered, 1527.

Somer's Isles discovered, 1527.

St. Eustatia Isle settled by Holland, 1632.

St. Lawrence River discovered and explored by the French, 1508.

St. Salvador, Guanihani, or Cat Island, was the first land discovered in the West Indies, or America, by Columbus, October 11, 1492.

Suffolk Isles discovered, 1764; first produced sugar, 1770.

Surinam planted by England, 1640.

Surat settled, 1603.

Tate Islands, East Indies, discovered, June 29, 1795.

Tobago planted by the Dutch, 1642.

Terceras Isles discovered by the Spaniards, 1583.

Terra Firma settled by the Spaniards, 1524.

Trinidad, The Isle of, discovered, 1498.

Ukraine settled by Russia, 1752.

Virginia discovered by Sir Walter Raleigh, 1584; the settlement of the first permanent colony there, 1607.

West Indies discovered by Columbus, 1492.

The Political Divisions of the World, Arranged According to Size.

	Sq. miles.
Russian Empire	7,862,568
Chinese Empire	4,695,334
British Empire	4,419,559
United States	3,578,392
British N. Am.	3,523,083
Brazil	3,231,047
Australian Cont.	2,945,219
Turkish Empire	1,917,472
India	1,552,028
China (proper)	1,300,000
Argentine Repub.	826,828
Mexico	773,144
Egypt	659,081
Turkestan	640,516
Persia	562,344
Bolivia	535,769
Peru	510,107
Venezuela	368,235
U. S. of Colombia	357,179
Tripoli	344,423
Morocco	259,593
Afghanistan	258,530
Texas	247,356
Austria,	240,381
Madagascar	232,315
Ecuador	218,984
France	209,428
Spain	195,607
California	188,981
Central America	178,869
Sweden	170,634
Beloochistan	165,830
German Empire	160,207
Abyssinia	158,392
Dakota	152,000
Japan	149,399
Montana	143,776
Prussia	135,806
Chili	132,624
Paraguay	126,352
New Mexico	121,201
Great Britain	121,115
Norway	120,295
Arizona	113,916
Nevada	112,090
Italy	109,837
Colorado	104,500
Oregon	95,274
Idaho	90,932
Utah	88,056
Wyoming	88,000
Minnesota	83,531
Kansas	81,318
Transvaal Republic	77,964
Nebraska	75,995
Washington	69,994
Indian Territory	68,991
Uruguay	66,716
Missouri	65,350
Florida	59,268
Georgia	58,000
Michigan	56,451
Illinois	55,410
Iowa	55,045
Wisconsin	53,924
Arkansas	52,198
Alabama	50,722
North Carolina	50,704
Orange Free State	48,019
Mississippi	47,156
New York	47,000
Pennsylvania	46,000
Tunis	45,710
Tennessee	45,600
Louisiana	41,346
Ohio	39,964
Virginia	38,352
Portugal	37,977
Kentucky	37,680
Maine	35,000
South Carolina	34,000
Indiana	33,809
Bavaria	29,373
West Virginia	23,000
Servia	21,210
Greece	19,353
St. Domingo	17,826
Switzerland	15,722
Denmark	14,734
Netherlands	12,680
Belgium	11,373
Maryland	12,124
Vermont	10,212
Hayti	10,205
Liberia	9,567
New Hampshire	9,280
Fejee Islands	8,033
Massachusetts	7,800
Sandwich Islands	7,633
New Jersey	7,570
Wurtemburg	7,532
Baden	5,912
Saxony	5,779
Mecklenburg-Schwerin	5,190
Connecticut	4,674
Papal States	4,552
Hesse Darmstadt	2,969
Oldenburg	2,469

Wealth of Principal Nations.

Argen. Rep.	$1,660,000,000	Greece	$1,055,000,000
Australia	4,950,000,000	Holland	4,935,000,000
Austria	18,060,000,000	Italy	12,755,000,000
Belgium	4,030,000,000	Mexico	3,190,000,000
Canada	3,250,000,000	Norway	1,410,000,000
Denmark	1,830,000,000	Portugal	1,855,000,000
France	40,300,000,000	Spain	7,965,000,000
Germany	31,615,000,000	Sweden	3,475,000,000
Great Britain and Ireland	43,600,000,000	Switzerland	1,620,000,000
		U. States	47,475,000,000

Money.

Money first mentioned as a medium of commerce in the twenty-third chapter of Genesis, when Abraham purchased a field as a sepulcher for Sarah, in the year of the world 2139; first made at Argos, 894 before Christ. Silver has increased 30 times its value since the Norman conquest, viz: a pound in that age was three times the quantity what it is at present, and ten times its value in purchasing any commodity; first coined in the United States, 1652; first paper money, 1690.

Weight of a Million Dollars.

The United States gold dollar contains 25.8 troy grains. A troy pound contains 5760 troy grains, but the ordinary pound of currency, avoirdupois, weighs 7000 troy grains. Therefore $1,000,000 in United States gold coin weigh 3686.4 pounds avoirdupois. A United States standard silver dollar weighs 412.5 troy grains. $1,000,000 in United States silver coin of the present standard weigh 56,931 pounds avoirdupois, or nearly 28¼ tons.

Foundations of Fortunes.

Senator Farwell began life as a surveyor.

Cornelius Vanderbilt began life as a farmer.

Wanamaker's first salary was $1.25 a week.

A. T. Stewart made his start as a school-teacher.

Jim Keene drove a milk-wagon in a California town.

Cyrus Field began life as a clerk in a New England store.

Pulitzer once acted as stoker on a Mississippi steamboat.

"Lucky" Baldwin worked on his father's farm in Indiana.

Dave Sinton sold sugar over an Ohio counter for $1 a week.

Moses Taylor clerked in Water street, New York, at $2 a week.

George W. Childs was an errand boy for a bookseller at $4 a month.

J. C. Flood, the California millionaire, kept a saloon in San Francisco.

P. T. Barnum earned a salary as bartender in Niblo's Theatre New York.

Jay Gould canvassed Delaware County, New York, selling maps at $1.50 apiece.

C. P. Huntington sold butter and eggs for what he could get a pound and dozen.

Andrew Carnegie did his first work in a Pittsburgh telegraph office at $3 a week.

Whitelaw Reid did work as correspondent of a Cincinnati newspaper for $5 a week.

Adam Forepaugh was a butcher in Philadelphia when he decided to go into the show business.

Senator Brown made his first money by plowing his neighbor's fields with a pair of bull calves.

A Business Lesson.

Peter Cooper was one of the most successful, careful, and prudent business men of his time. He was strongly opposed to the methods of many merchants who launched out into extravagant enterprises on borrowed money, for which they paid exorbitant rate of interest. The following anecdote illustrates this point very forcibly:

Once, while talking about a project with an acquaintance, the latter said he would have to borrow the money for six months, paying interest at the rate of 3 per cent. per month.

"Why do you borrow for so short a time?" Mr. Cooper asked.

"Because the brokers will not negotiate bills for longer."

"Well, if you wish," said Mr. Cooper, "I will discount your note at that rate for three years."

"Are you in earnest?" asked the would-be borrower.

"Certainly, I am. I will discount your note for $10,000 for three years at that rate. Will you do it?"

"Of course I will," said the merchant.

"Very well," said Mr. Cooper; "just sign this note for $10,000 payable in three years, and give your check for $800, and the transaction will be complete."

"But where is the money for me?" asked the astonished merchant.

"You don't get any money," was the reply. "Your interest for thirty-six months at three per centum per month amounts to 108 per centum, or $10,800; therefore your check for $800 just makes us even."

The force of this practical illustration of the folly of paying such an exorbitant price for the use of money was such that the merchant determined never to borrow at such ruinous rates, and he frequently used to say that nothing could have so fully convinced him as this rather humorous proposal by Mr. Cooper.

Avoid Debt.

Every man who would get on in the world should, as far as possible, avoid debt. From the very outset of his career he should resolve to live within his income, however paltry it may be. The art of living easily as to money is very simple—pitch your scale of living one degree below your means. All the world's wisdom on the subject is most tersely epitomized in the words of Dickens's Micawber: "Annual income, twenty pounds; annual expenditure, nineteen six; result, happiness. Annual income, twenty pounds; annual expenditure, twenty pounds naught and six; result, misery." Many a man dates his downfall from the day when he began borrowing money. Avoid the first obligation, for, that incurred, others follow, one necessitating the other; every day the victim will get more entangled; then follow pretexts, excuses, lies, till all sense of shame is lost, the whole life becomes a makeshift, and the debtor

in despair finally resolves to live by indirect robbery and falsehood.

Getting Rich by Small Inventions.

The New Jersey man who hit upon the idea of attaching a rubber erasing tip to the end of the lead pencil is worth $200,000.

The miner who invented a metal rivet or eyelet at each end of the mouth of coat and trowsers pockets, to resist the strain caused by the carriage of pieces of ore and heavy tools, has made more money from his letters patent than he would have made had he struck a good vein of gold-bearing quartz.

Every one has seen the metal plates that are used to protect the heels and soles of rough shoes, but every one doesn't know that within ten years the man who hit upon the idea has made $250,000.

As large a sum as was ever obtained for any invention was enjoyed by the Yankee who invented the inverted glass bell to hang over gas-jets to protect ceilings from being blackened by smoke.

The inventor of the roller skate has made $1,000,000, notwithstanding the fact that his patent had nearly expired before the value of it was ascertained in the craze for roller skating that spread over the country a few years ago.

The gimlet-pointed screw has produced more wealth than most silver mines, and the Connecticut man who first thought of putting copper tips on the toes of children's shoes is as well off as if he had inherited $1,000,000, for that's the amount his idea has realized for him.

The common needle threader which every one has seen for sale, and which every woman owns, was a boon to needle users. The man who invented it has an income of $10,000 a year from his invention.

A minister in England made $50,000 by inventing an odd toy that danced by winding it with a string.

The man who invented the return ball, an ordinary wooden ball with a rubber string attached to pull it back, made $1,000,000 from it.

Results of Saving Small Amounts of Money.

The following shows how easy it is to accumulate a fortune, provided proper steps are taken. The table shows what would be the result at the end of fifty years by saving a certain amount each day and putting it at interest at the rate of six per cent.:

Daily Savings.	The result.	Daily Savings.	The result.
One cent	$ 950	Sixty cents	$57,024
Ten cents	9,504	Seventy cents	66,528
Twenty cents	19,006	Eighty cents	76,032
Thirty cents	28,512	Ninety cents	85,537
Forty cents	38,015	One dollar	95,041
Fifty cents	47,520	Five dollars	475,208

Nearly every person wastes enough in twenty or thirty years, which, if saved and carefully invested, would make a family quite independent; but the principle of small savings has been lost sight of in the general desire to become wealthy.

What a Dollar Saved Each Day Will Earn.

One dollar per day saved in the cost of fuel amounts, with interest, on basis of 312 working days in a year, to following:

	Four Per Cent.	Six Per Cent.	Eight Per Cent.	Ten Per Cent.
One Year	$324 48	$330 72	$336 96	$343 20
Five Years	1,757 50	1,864 20	1,976 80	2,095 26
Ten Years	3,895 76	4,359 14	4,881 40	5,469 73
Fifteen Years	6,479 24	7,697 82	9,149 18	10,904 30
Twenty Years	9,662 39	12,165 72	15,419 94	19,656 78

Value of Metals.

Fully ninety-nine persons in every hundred, if asked to name the most precious metals, would mention gold as first, platinum as second, silver as third. If asked to name others a few might add nickel, and a very few aluminum to the list.

Let us see how near the truth they would be. Gold is worth about $240 per pound, troy; platinum $130, and silver about $12. Nickel would be quoted at about 60 cents and pure aluminum $8 to $9 to the troy pound.

We will now compare these prices with those of the rarer and less well known of the metals. To take them in alphabetical order, barium sells for $975 a pound, when it is sold at all, and calcium is worth $1,800 a pound, while cerium is a shade higher—its cost is $160 an ounce, or $1,920 a pound. Chromium brings $200; cobalt falls to about half the price of silver, while didymium is the same price as cerium, and cerium $10 cheaper on the ounce than calcium, or just $1,680 per pound.

If the wealth of the Vanderbilts be not overestimated, it amounts to nearly $200,000,000. With this sum they could purchase 312 tons of gold and have something left over, but they couldn't buy two tons of gallium, that rare metal being worth $4,250 an ounce. With this metal the highest price is reached, and it may well be called the rarest and most precious of metals.

Glucinum is worth $250 per ounce; indium, $158; irinium, $658 per pound; lanthanium, $175, and linthium, $160 per ounce. Niobium costs $128 per ounce; asmium, paladium, platinum, potassium and rhodium bring respectively, $640, $400, $39, $32 and $512 per pound. Strontium costs $128 an ounce; tantium, $144; tellurium, $9; athorium, $272; vanadium, $320; vitrium, $144, and ziconium, $250 an ounce.

Barium is more than four times as valuable as gold, and gallium more than 162 times as costly, while many of the metals are twice and thrice as valuable.

Aluminum, which now costs $8 to $9 a pound, will eventually be produced as cheap as steel.

Lightning conductors afford protection over a circle whose radius equals their height from the ground; formerly considered twice.

Average Annual Rainfall in the United States.

PLACE	Inches.	PLACE.	Inches.
Neah Bay, Wash. Ter.	123	Hanover, N. H.	40
Sitka, Alaska	83	Ft. Vancouver	38
Ft. Haskins, Oregon	66	Cleveland, Ohio	37
Mt. Vernon, Alabama	66	Pittsburgh, Pa	37
Baton Rouge, La	60	Washington, D. C	37
Meadow Valley, Cal.	57	White Sulph'r Spgs., Va.	37
Ft. Tonson, Indian Ter.	57	Ft. Gibson, Indian Ter.	36
Ft. Myers, Florida	56	Key West, Florida	36
Washington, Arkansas.	54	Peoria, Illinois	35
Huntsville, Alabama	54	Burlington, Vermont	34
Natchez, Mississippi	53	Buffalo, New York	33
New Orleans, La	51	Ft. Brown, Texas	33
Savannah, Georgia	48	Ft. Leavenworth, Kan.	31
Springdale, Kentucky	48	Detroit, Michigan	30
Fortress Monroe, Va.	47	Milwaukee, Wisconsin	30
Memphis, Tennessee	45	Penn Yan, New York	28
Newark, New Jersey	44	Ft. Kearney	25
Boston, Massachusetts	44	Ft. Snelling, Minnesota	25
Brunswick, Maine	44	Salt Lake City, Utah Ter.	23
Cincinnati, Ohio	44	Mackinac, Michigan	23
New Haven, Conn	44	San Francisco, Cal.	21
Philadelphia, Pa	44	Dallas, Oregon	21
Charleston, S. Carolina	43	Sacramento, California	21
New York City, N. Y.	43	Ft. Massachusetts, Col.	17
Gaston, N. Carolina	43	Ft. Marcy, New Mex. T.	16
Richmond, Indiana	43	Ft. Randall, Dakota T.	16
Marietta, Ohio	43	Ft. Defiance, Arizona	14
St. Louis, Missouri	43	Ft. Craig, New Mex. T.	11
Muscatine, Iowa	42	San Diego, California	9
Baltimore, Maryland	41	Ft. Colville, Wash. Ter.	9
New Bedford, Mass	41	Ft. Bliss, Texas	9
Providence, R. I	41	Ft. Bridger, Utah Ter.	6
Ft. Smith, Arkansas	40	Ft. Garland, Colorado	6

Average Annual Temperature in United States.

Place of Observation.	Average Temperature.	Place of Observation.	Average Temperature.
Tucson, Arizona	69	Salt Lake City, Utah	52
Jacksonville, Florida	69	Romney, West Virginia	52
New Orleans, La	69	Indianapolis, Indiana	51
Austin, Texas	67	Leavenworth, Kansas,	51
Mobile, Alabama	66	Sante Fe, New Mex. Ter.	51
Jackson, Mississippi	64	Steilacoom, W. Ter	51
Little Rock, Arkansas	63	Hartford, Connecticut	50
Columbia, S. Carolina	62	Springfield, Illinois	50
Ft. Gibson, Indian Ter.	60	Camp Scott, Nevada	50
Raleigh, North Carolina	59	Des Moines, Iowa	49
Atlanta, Georgia	58	Omaha, Nebraska	49
Nashville, Tennessee	58	Denver, Colorado	48
Richmond, Virginia	57	Boston, Massachusetts	48
Louisville, Kentucky	56	Albany, New York	48
San Francisco, Cal	55	Providence, R. I	48
Washington, D. C	55	Detroit, Michigan	47
St. Louis, Missouri	55	Ft. Randall, Dakota Ter.	47
Baltimore, Maryland	54	Sitka, Alaska	46
Harrisburg, Pa	54	Concord, N. H	46
Wilmington, Delaware	53	Augusta, Maine	45
Trenton, New Jersey	53	Madison, Wisconsin	45
Columbus, Ohio	53	Helena, Montana Ter.	43
Portland, Oregon	53	Montpelier, Vermont	43
Ft. Boise, Idaho	52	St. Paul, Minnesota	42

The Derivations of the Names of the Months.

JANUARY.—The Roman Janus presided over the beginning of everything; hence the first month of the year was called after him.

FEBRUARY.—The Roman festival Februs was held on the 15th day of this month, in honor of Lupercus, the god of fertility.

MARCH.—Named from the Roman god of war, Mars.

APRIL.—Latin, Aprilis, probably derived from aperire, to open; because spring generally begins and the buds open in this month.

MAY.—Latin, Maius, probably derived from Maia, a femine divinity worshiped at Rome on the first day of this month.

JUNE.—Juno, a Roman divinity worshiped as the Queen of Heaven.

JULY (Julius).—Julius Cæsar was born in this month.

AUGUST.—Named by the Emperor Augustus Cæsar, B. C. 30, after himself, as he regarded it a fortunate month, being that in which he had gained several victories.

SEPTEMBER.—Latin, septem or 7. September was the seventh month in the old Roman calendar.

OCTOBER.—Latin, octo. Eighth month of the old Roman year.

NOVEMBER.—Latin, novem, or 9. November was the ninth month in the old Roman year.

DECEMBER.—Latin, decem, or 10. December was the tenth month of the early Roman year. About the 21st of this month the sun enters the Tropic of Capricorn, and forms the winter solstice.

Days of the Week.

SUNDAY.—Saxon, Sunnandæg, day of the sun.

MONDAY.—German, Montag, day of the moon.

TUESDAY.—Ang-Saxon, Tiwesdæg, from Tw, the god of war.

WEDNESDAY.—Ang-Saxon, Wodnesdæg, from Odin, the god of storms.

THURSDAY.—Danish, Thor, the god of thunder.

FRIDAY.—Saxon, Frigedæg, day of Freya, goddess of marriage.

SATURDAY.—Day of Saturn, the god of time.

The names of the seven days of the week originated with the Egyptian astronomers. They gave them the names of the sun, moon and five planets: viz., Mars, Mercury, Jupiter, Venus and Saturn.

The Chinese and Thibetans have a week of five days named after iron, wood, water, feathers and earth.

Principal Exports of Various Countries.

ARABIA.—Coffee, aloes, myrrh, frankincense, gum arabic.

BELGIUM.—Grain, flax, hops, woolens, linens, laces, various manufactures.

BRAZIL.—Cotton, sugar, coffee, tobacco, gold, diamonds, wheat and dry-goods.

CANADA, NOVA SCOTIA AND NEW BRUNSWICK.—Flour, furs, lumber, fish.

CAPE COLONY.—Brandy, wine, ostrich feathers, hides, tallow.

CENTRAL AMERICA.—Logwood, mahogany, indigo, cocoa.

CHILI.—Silver, gold, copper, wheat, hemp, hides, sugar, cotton, fruits.

CHINA.—Tea, silks, nankeens, porcelain, opium, articles of ivory and pearl.

DENMARK.—Grain, horses, cattle, beef, pork, butter, cheese.

EASTERN, WESTERN AND SOUTHERN AFRICA.—Gold, ivory, ostrich feathers.

EGYPT.—Rice, grain, linseed, fruits, indigo, cotton, sugar.

ECUADOR AND NEW GRENADA.—Coffee, cotton, indigo, cocoa, fruits, sugar.

FRANCE—Silks, woolens, linens, cotton, wine, brandy, porcelain, toys.

GERMANY.—Linen, grain, various manufactures of silver, copper, etc.

GREAT BRITAIN.—Woolens, cottons, linens, hardware, porcelain, etc.

GREENLAND.—Whale oil, whale bone, seal skins.

HINDOOSTAN.—Cotton, silks, rice, sugar, coffee, opium, indigo.

HOLLAND.—Fine linens, woolens, butter, cheese, various manufactures.

ITALY.—Silks, wine, oil, grain, fruits.

IRELAND.—Linens, beef, butter, tallow, hides, potatoes, barley.

JAPAN.—Silk and cotton goods, japanware, porcelain.

MEXICO.—Gold, silver, logwood, cochineal, fruits.

PERSIA.—Carpets, shawls, wine, silk, cotton, rice, rhubarb, guns, swords, etc.

PERU.—Silver, gold, Peruvian bark, mercury, sugar, cotton, fruits.

RUSSIA.—Hemp, iron, linen, grain, timber, furs, tallow, platina.

SPAIN AND PORTUGAL.—Silks, wool, wine, oil, fruits, salt.

SWEDEN AND NORWAY.—Iron, steel, copper, timber, fish.

SWITZERLAND.—Watches, jewelry, paper, laces, linen, cotton and silk goods, etc.

TURKEY.—Grain, fruits, cotton, oil, wines, carpets, muslin, swords.

UNITED STATES.—

Eastern States.—Lumber, beef, pork, fish, cottons, woolens, etc.

Middle States.—Flour, wheat, salt, coal, cottons, woolens.

Southern States.—Cotton, rice, tobacco, corn, lumber, pitch, fruits.

Western States.—Corn, wheat, lead, coal, iron, salt, lime, beef, pork.

VENEZUELA.—Sugar, coffee, cocoa, cotton, indigo, fruits.

WEST INDIES.—Sugar, rum, molasses, coffee, spice, cotton, indigo, fruits.

Salaries Paid to Heads of Governments.

Various governments pay their chiefs as follows: The United States, $50,000 a year; Persia, $30,000,000; Russia, $10,000,000; Siam, $10,000,000; Spain, $3,900,000; Italy, $3,000,000; Great Britain, $3,000,000; Morocco, $2,500,000; Japan, $2,300,000; Egypt, $1,575,000; Germany, $1,000,000; Saxony, $700,000; Portugal, Sweden and Brazil, each $600,000; France, $200,000; Hayti, $240,000; Switzerland, $3,000.

Sovereigns of England.

"First William the Norman;
Then William, his son,
Henry, Stephen and Henry,
Then Richard and John;
Next, Henry the third,
Edwards, one, two, three,
And again, after Richard,
Three Henrys we see.
Two Edwards, third Richard,
If rightly I guess;
Two Henrys, sixth Edward,
Queen Mary, Queen Bess,
Then Jamie, the Scotchman,
Then Charles, whom they slew,
Yet received after Cromwell
Another Charles, too;
Next James the second
Ascended the throne;
Then good William and Mary
Together came on;
'Till Annie, Georges four
And fourth William all gone;
God sent us Victoria,
Who was excelled by none,
Then Edward the seventh,
Her illustrious son."

The Smallest Republic in Europe.

The honor which was claimed for Gersau belongs to the independent hamlet of Foust. This pretty group of huts, situated a few hours distant from Oleron, in the department of the lower Pyrenees, belongs neither to France nor Spain. It has somewhat over 100 citizens. They have no mayor or other civil official. They have not even an established church or priest of their own, but attend at a neighboring village. The very weakness of this little republic preserves it in existence.

What Royalty Costs England.

As a sample of what royalty costs the people of Great Britain alone, Whitaker gives the following annuities to the royal family:

Her Majesty—

Privy purse	£60,000
Salaries of household	131,260
Expenses of household	172,500
Royal bounty, etc	13,500
Unappropriated	8,540
	£385,800
Prince of Wales	40,000
Princess of Wales	10,000
Prince Albert Victor	10,000
Crown Princess of Prussia	8,000
Duke of Edinburgh	25,000
Princess Christian of Schleswig-Holstein	6,000
Princess Louise (Marchioness of Lorne)	6,000
Duke of Connaught	25,000
Duke of Albany	25,000
Duke of Cambridge	6,000
Duchess of Mecklenburg-Strelitz	3,000
Duke of Cambridge	12,000
Duchess of Teck	5,000
Total	£566,800 or $2,834,000

Carlisle Tables of Mortality.

Showing how many persons out of 10,000 will die annually, on the average until all are deceased. Used by Life Insurance Companies.

Year.	No. Alive.	Deaths.	Year.	No. Alive.	Deaths.
At Birth.	10,000	1,539	41	5,009	69
1	8,461	682	42	4,940	71
2	7,779	505	43	4,869	71
3	7,274	276	44	4,798	71
4	6,998	201	45	4,727	70
5	6,797	121	46	4,657	69
6	6,670	82	47	4,588	67
7	6,594	58	48	4,521	63
8	6,536	48	49	4,458	61
9	6,493	33	50	4,397	59
10	6,460	29	51	4,338	62
11	6,431	31	52	4,276	65
12	6,400	32	53	4,211	68
13	6,368	33	54	4,143	70
14	6,335	35	55	4,073	73
15	6,300	39	56	4,000	76
16	6,261	42	57	3,924	82
17	6,219	43	58	3,842	93
18	6,176	43	59	3,749	106
19	6,133	43	60	3,633	122
20	6,090	43	61	3,521	126
21	6,047	42	62	3,395	127
22	6,005	42	63	3,268	125
23	5,963	42	64	3,143	125
24	5,921	42	65	3,018	124
25	5,879	43	66	2,894	123
26	5,836	43	67	2,771	123
27	5,793	45	68	2,648	123
28	5,748	50	69	2,525	124
29	5,698	56	70	2,401	124
30	5,642	57	71	2,277	134
31	5,585	57	72	2,143	146
32	5,528	56	73	1,997	156
33	5,472	55	74	1,841	166
34	5,417	55	75	1,675	160
35	5,362	55	76	1,515	156
36	5,307	56	77	1,359	146
37	5,251	57	78	1,213	132
38	5,194	58	79	1,081	128
39	5,136	61	80	953	116
40	5,075	66	81	837	112

How Human Life is Spent.

According to a French statistician, taking the me of many accounts, a man of 50 years of age has sle 6,000 days, worked 6,500 days, walked 800 days, amu ed himself 4,000 days, was eating 1,500 days, was si 500 days, etc. He ate 17,000 pounds of bread, 16,0 pounds of meat, 4,600 pounds of vegetables, eggs a fish, and drank 7,000 gallons of liquid, namely, wate tea, coffee, beer, wine, etc., altogether.

How to tell the Age of any Person.

There is a good deal of amusement in the followi magical table of figures. It will enable you to tell hc old the young ladies are. Just hand this table to young lady, and request her to tell you in which c umn or columns her age is contained, and add togeth the figures at the top of the columns in which her a is found, and you have the great secret. Thus, su pose her age to be 17, you will find that number in t first and fifth columns; add the first figures of the two columns.

Here is the magic table:

1	2	4	8	16	32
3	3	5	9	17	33
5	6	6	10	18	34
7	7	7	11	19	35
9	10	12	12	20	36
11	11	13	13	21	37
13	14	14	14	22	38
15	15	15	15	23	39
17	18	20	24	24	40
19	19	21	25	25	41
21	22	22	26	26	42
23	23	23	27	27	43
25	26	28	28	28	44
27	27	29	29	29	45
29	30	30	30	30	46
31	31	31	31	31	47
33	34	36	40	48	48
35	35	37	41	49	49
37	38	38	42	50	50
39	39	39	43	51	51
41	42	44	44	52	52
43	43	45	45	53	53
45	46	46	46	54	54
47	47	47	47	55	55
49	50	52	56	56	56
51	51	53	57	57	57
53	54	54	58	58	58
55	55	55	59	59	59
57	58	60	60	60	60
59	59	61	61	61	61
61	62	62	62	62	62
63	63	63	63	63	63

Another Method of Telling Any One's Ag

Girls of a marriageable age do not like to tell ho old they are, but you can find out by following su joined instructions, the young lady doing the figurin Tell her to put down the number of the month in whi she was born; then to multiply it by two; then to a five; then to multiply it by 50; then to add her ag then to subtract 365; then to add 115; then tell he

tell you the amount she has left. The two figures to the right will denote her age, and the remainder the month of her birth. For example, the amount is 822, she is twenty-two years old, and was born in the eighth month (August). Try it.

A Lady's Chance of Marrying

Every woman has some chance to marry; it may be one to fifty, or it may be ten to one that she will. Representing her entire chance at one hundred at certain points of her progress in time, it is found to be in the following ratio:

Between the ages of 15 and 20 years.....14½ per cent.
Between the ages of 20 and 25 years..... 52 per cent.
Between the ages of 25 and 30 years..... 18 per cent.
Between the ages of 30 and 35 years.....15½ per cent.
Between the ages of 35 and 40 years..... 3¾ per cent.
Between the ages of 40 and 45 years..... 2½ per cent.
Between the ages of 45 and 50 years...⅜ of 1 per cent.
Between the ages of 50 and 56 years...¼ of 1 per cent.

After sixty it is one-tenth of one per cent. or one chance in a thousand. A pretty slender figure—but FIGURES are often SLENDER at that age.

Mode of Execution in Every Country.

Country.	Mode.	Publicity.
Austria	Gallows	Public.
Bavaria	Guillotine	Private.
Belgium	Guillotine	Public.
Brunswick	Ax	Private.
China	Sword or cord	Public.
Denmark	Guillotine	Public.
Ecuador	Musket	Public.
France	Guillotine	Public.
Great Britain	Gallows	Private.
Hanover	Guillotine	Private.
Italy	Sword or gallows*	Public.
Netherlands	Gallows	Public.
Oldenberg	Musket	Public.
Portugal	Gallows	Public.
Prussia	Sword	Private.
Russia	Musket, gallows, or sword	Public.
Saxony	Guillotine	Private.
Spain	Garrote	Public.
Switzerland—		
Fifteen cantons	Sword	Public.
Two cantons	Guillotine	Public.
Two cantons	Guillotine	Private.
United States (other than New York)	Gallows	Mostly Private.
New York	Electricity	Private.

*Capital punishment abolished in 1876.

Antidotes for Poisons.

In cases where the other articles to be used as antidotes are not in the house, give two tablespoonfuls of mustard mixed in a pint of warm water. Also give large draughts of warm milk or water mixed with oil, butter or lard. If possible give as follows:

FOR BED-BUG POISON, BLUE VITRIOL, CORROSIVE SUBLIMATE, LEAD WATER, SALTPETRE, SUGAR OF LEAD, SULPHATE OF ZINC, RED PRECIPITATE, VERMILION,	Give Milk or White of Eggs, in large quantities.
FOR FOWLER'S SOLUTION, WHITE PRECIPITATE, ARSENIC,	Give prompt Emetic of Mustard and Salt—tablespoonful of each; follow with Sweet Oil, Butter or Milk.
FOR ANTIMONIAL WINE, TARTAR EMETIC,	Drink warm water to encourage vomiting. If vomiting does not stop, give a Grain of Opium in water.
FOR OIL VITRIOL, AQUA FORTIS, BI-CARBONATE POTASSA, MURIATIC ACID, OXALIC ACID	Magnesia or Soap, dissolved in water, every two minutes.
FOR CAUSTIC SODA, CAUSTIC POTASH, VOLATILE ALKALI,	Drink freely of water with Vinegar or Lemon Juice in it.
FOR CARBOLIC ACID	Give Flour and Water or Glutinous drinks.
FOR CHLORAL HYDRATE, CHLOROFORM,	Pour cold water over the head and face, with artificial respiration, Galvanic Battery.
FOR CARBONATE OF SODA, COPPERAS, COBALT,	Prompt Emetic; Soap or Mucilaginous drinks.
FOR LAUDANUM, MORPHINE, OPIUM,	Strong Coffee, followed by Ground Mustard, or Grease in warm water to produce vomiting. Keep in motion.
FOR NITRITE OF SILVER—Give common Salt in water.	
FOR STRYCHNINE, TINCT. NUX VOMICA	Emetic of Mustard or Sulphate of Zinc, aided by warm water.

Powers of Locomotion of Animals, and Average Velocities of Various Bodies.

	Per hour		Per Sec.
A man walks	3 miles, or		4 feet.
A horse trots	7 "	or	10 "
A horse runs	20 "	or	29 "
Steamboat runs	18 "	or	26 "
Sailing vessel runs	10 "	or	14 "
Slow rivers flow	3 "	or	4 "
Rapid rivers flow	7 "	or	10 "
A moderate wind blows	7 "	or	10 "
A storm moves	36 "	or	52 "
A hurricane moves	80 "	or	117 "
A rifle ball moves	1,000 "	or	1,466 "
Sound moves	743 "	or	1,142 "
Light moves	192,000 miles per second.		
Electricity moves	288,000 miles per second.		

The Pulse.

The natural rate of the pulse varies at different ages as follows:

	Beats per Minute.
At birth	130—140
One year	115—130
Two years	100—115
Three years	95—105
Four to seven years	85— 95
Seven to fourteen years	80— 90
Fourteen to twenty-one years	75— 85
Twenty-one to sixty years	70— 75
Old age	75— 85

Periods of Digestion.

SUBSTANCE.	H.	M.
Rice, boiled	1	
Eggs, whipped, raw	1	30
Trout, fresh, fried	1	30
Soup, barley, boiled	1	30
Apples, sweet, mellow, raw	1	30
Venison steak, broiled	1	45
Sago, boiled	1	45
Tapioca, boiled	2	
Barley, boiled	2	
Milk, boiled	2	
Liver, beef, fresh, broiled	2	
Eggs, fresh, raw	2	
Apples, sour, mellow, raw	2	
Cabbage, with vinegar, raw	2	
Milk, raw	2	15
Eggs, fresh, roasted	2	15
Turkey, domestic, roasted	2	30
Goose, wild, roasted	2	30
Cake, sponge, baked	2	30
Hash, warmed	2	30
Beans, pod, boiled	2	30
Parsnips, boiled	2	30
Potatoes, Irish, baked	2	30
Cabbage, head, raw	2	30
Custard, baked	2	45
Apples, sour, hard, raw	2	50
Oysters, fresh, raw	2	55
Eggs, fresh, soft boiled	3	
Beefsteak, broiled	3	
Mutton, fresh, broiled	3	
Mutton, fresh, boiled	3	
Soup, bean, boiled	3	
Chicken soup, boiled	3	
Dumpling, apple, boiled	3	
Oysters, fresh, roasted	3	15
Pork, salted, broiled	3	15
Porksteak, broiled	3	15
Mutton, fresh, roasted	3	15
Bread, corn, baked	3	15
Carrot, orange, boiled	3	15
Sausage, fresh, broiled	3	20
Oysters, fresh, stewed	3	30
Butter, melted	3	30
Cheese, old, raw	3	30
Oyster soup, boiled	3	30
Bread, wheat, fresh, baked	3	30
Turnips, flat, boiled	3	30
Potatoes, Irish, boiled	3	30
Eggs, fresh, hard boiled	3	30
Eggs, fresh, fried	3	30
Green corn and beans, boiled	3	45
Beets, boiled	3	45
Salmon, salted, boiled	4	
Beef, fried	4	
Veal, fresh, broiled	4	
Fowls, domestic, boiled	4	
Beef, old, salted, boiled	4	15
Pork, salted, fried	4	15
Pork, salted, boiled	4	30
Veal, fresh, fried	4	30
Cabbage, boiled	4	30
Pork, roasted	5	15
Suet, beef, boiled	5	30

Percentage of Nutrition in Various Articles of Food.

Raw Cucumbers	2	Roast Poultry	26
Raw Melons	3	Raw Beef	26
Boiled Turnips	4½	Raw Grapes	27
Milk	7	Raw Plums	29
Cabbage	7½	Broiled Mutton	30
Apples	10	Oatmeal Porridge	75
Currants	10	Rye Bread	79
Whipped Eggs	13	Boiled Beans	87
Beets	14	Boiled Rice	88
Apples	16	Barley Bread	88
Peaches	20	Wheat Bread	90
Boiled Codfish	21	Baked Corn Bread	91
Broiled Venison	22	Boiled Barley	92
Potatoes	22½	Butter	92
Fried Veal	24	Boiled Peas	93
Roast Pork	24	Raw Oils	95

Percentage of Alcohol in Various Liquors.

Scotch Whisky	54.53	Currant Wine	20.50
Irish Whisky	53.9	Port	22.90
Rum	53.68	Madeira	22.27
Gin	51.6	Teneriffe	19.79
Brandy	53.39	Sherry	19.17
Burgundy	14.57	Claret	15.1
Cape Muscat	18.25	Elder	8.79
Champagne (still)	13.80	Ale	6.87
Champagne (sp'rkl'g)	12.61	Porter	4.02
Cider	5.2 to 9.8	Malaga	17.26
Constantia	19.75	Rhenish	12.8
Gooseberry Wine	11.48	Small Beer	1.28

Weight of Eggs.

The following table of the weight of eggs per pound of various breeds of fowls and the number of eggs laid in a year is approximately fair, though it may vary under exceptionally adverse or favorable conditions:

Varieties.	Eggs Per lb.	No. Eggs Per Year.
Light Brahmas	7	130
Dark Brahmas	8	130
Partridge Cochins	7	130
Black, White, Buff Cochins	7	120
Plymouth Rocks	8	150
Houdans	8	155
La Fleche	7	135
Creve Cœurs	8	145
Black Spanish	8	155
Leghorns	8	160
Hamburgs	9	150
Dominiques	8	135
Games	9	140
Bantams	16	90

Food in an Egg.

An egg contains as much nourishment as a pound and an ounce of cherries, a pound and a quarter of grapes, a pound and a half of russet apples, two pounds of gooseberries and four pounds of pears; and 114 pounds of grapes, 127 pounds of russet apples, 192 pounds of pears, and 327 pounds of plums are equal in nourishment to 100 pounds of potatoes.

Rules for the Management of Poultry.

1. Good dry houses, well ventilated but void of drafts.

2. Keep your hen houses clean and the floor covered with ashes.

3. Whitewash inside monthly from March 1st to October 1st.

4. Feed regularly, but never overfeed; cease feeding when the fowls cease to run for it.

5. Scatter the food on the ground when the weather will permit.

6. Feed mixed grain, or alternate, as corn one day, oats next, wheat next, etc.

7. Allow adult fowls freedom as early in the morning as they desire.

8. Keep hens with chicks in small coops (well covered and dry) until the chicks are three weeks old.

9. Feed chicks morning, noon and afternoon.

10. Mix ground black pepper with the morning food.

11. Grease the hens well under the wings, breast and fluff feathers as soon as the chicks are taken off, with ointment made of lard and carbolic acid; one tablespoonful of lard to ten drops of acid.

Box Measures.

Farmers and market gardeners will find a series of box measures very useful, and they can readily be made by anyone who understands the two-foot rule and can handle the saw and hammer. The following measurements, it will be seen, vary slightly from the United States bushel adopted by some of the States, but are sufficiently accurate for all ordinary purposes:

A box 16 by 16⅓ inches square and 8 inches deep will contain a bushel, or 2150.4 cubic inches, each inch in depth holding one gallon.

A box 24 by 11.2 inches square and 8 inches deep will also contain a bushel, or 2150.4 cubic inches, each in depth holding 1 gallon. A box 12 by 11.2 inches square and 8 inches deep will contain half a bushel, or 1075.2 cubic inches, each inch in depth holding half a gallon.

A box 8 by 8.4 inches square and 8 inches deep will contain half a peck, or 298.8 cubic inches. The gallon, dry measure.

A box 4 by 4 inches square and 4.2 inches deep will contain 1 quart, or 67.2 cubic inches.

How to Drive Flies from Stables.

Scatter chloride of lime on a board in a stable, to remove all kinds of flies, but more especially biting flies. Sprinkling beds of vegetables with even a weak solution, effectually preserves them from caterpillars, slugs, etc. A paste of one part powdered chloride of lime, and a half part of some fatty matter placed in a narrow band round the trunk of the tree, prevents insects from creeping up it. Even rats, mice, cockroaches and crickets flee from it.

How to Keep Flies from Horses.

Procure a bunch of smartweed and bruise it to cause the juice to exude. Rub the animal thoroughly with the bunch of bruised weed, especially on the legs, neck and ears. Neither flies or other insects will trouble him for twenty-four hours. The process should be repeated every day. A very convenient way of using it is, to make a strong infusion by boiling the weed a few minutes in water. When cold it can be conveniently applied with a sponge or brush. Smartweed is found growing in every section of the country, usually on wet ground near highways.

A Rule for Determining the Weight of Live Cattle by Measurement.

There are many rules for estimating the weight of cattle by measurement, but one of the authorities on the subject says that "There is no rule that comes nearer than good guessing," and that no two animals will weigh alike according to measurement. The same authority further remarks that a rule, as good as any, is to find the superficial feet by multiplying the girth, just behind the shoulder-blade, by the length from the fore part of the shoulder-blade to the root of the tail. Thus an ox girthing seven feet nine inches, and measuring six feet in length, would contain seven and three-fourths times six or 46½ superficial feet. For cattle, grass fed, the following is given as the weight per superficial foot: Girth less than 3 feet, 11 pounds; girth 3 to 5 feet, 16 pounds; girth 5 to 7 feet, 23 pounds; girth 7 to 9 feet, 31 pounds.

GOOD HEALTH
AND
HOW TO PRESERVE IT

The Gymnasium

IN the gymnasium we call *ground* exercises those which are performed in the upright posture, and which consist in successive movements of flexion, extension, etc., of the legs, the arms, the trunk, the pelvis, and the neck. These are evidently, from an æsthetic point of view, the best of all exercises. Every limb does work in proportion to the strength of its muscles, for it moves only its own weight.

The body being supported on the legs during these exercises, the vertebral column has no tendency to assume a vicious attitude for the maintenance of an abnormal equilibrium.

These exercises would then be the best of all if they were a little more interesting to those who practise them. But they are very unattractive, as they suppress all initiative on the part of the pupil, and only need an attentive and passive obedience to orders.

There is happily another gymnastic exercise which combines with regularity in the expenditure of force a peculiar attraction, because it implies a contest of skill, agility and readiness: this is *French boxing*. This exercise is learned in a series of lessons of which each is performed alternately by the right and the left side of the body. In this manner the right leg and the right arm repeat exactly, when their turn comes, all the movements which have just been performed by the left arm and the left leg.

French boxing, in which blows are given with the feet as well as with the fist, needs every moment attitudes of great boldness.

Rapid Movements.

When a kick has to be given as high as the face, the trunk must be strongly inclined to the side to counterbalance the displacement of the centre of gravity, and this attitude would be vicious if it were always in the same direction. But the right leg, which has delivered a kick, has hardly returned to the ground when the left leg must take its turn, and repeat the attack, either directly forwards, or by the pirouette known as the *turning kick*.

With a rapidity which astonishes the spectator, the body must change from one leg to the other with a sufficiently stable equilib-



ATHLETIC EXERCISES FOR TRAINING THE BODY.

rium to propel the foot in a precise direction with great force. In order that the centre of gravity may be displaced with such marvellous ease, the vertebral column, which plays the part of a balancing-pole, must preserve an extreme mobility.

French boxing is, then, preferable to fencing for the regular development of the body of a young man and for preventing vicious carriage.

Swimming and Climbing.

Swimming needs a regular action of all the muscles. The body must progress in this exercise by a movement of extension which, beginning in the legs, spreads to the thighs, the vertebral column and the arms.

Climbing has a great resemblance to swimming. In both these exercises progression is brought about by alternate movements of flexion and extension of the body and limbs. Between these two methods of progression there seems to be at first sight only a difference of direction; in swimming it is horizontal, in climbing from below upwards.

But there is a capital difference as regards the mechanism of the work; in the swimmer the arms and shoulder move in the same horizontal plane; in the climber, on the contrary, the arms are much in advance of the chest, and their movements of flexion, the hands being fixed, tend to draw the shoulders upwards, forwards and inwards.

In the exercise of swimming there is no cause of deformity, and swimmers have, therefore, generally a very regular development.

There are certain exercises which seem at first sight to be performed by a very localized group of muscles, but which a more attentive analysis shows to be generalized throughout the body. Thus a man who rings a heavy bell does not only work with his hands which hold the rope, but with his arms which bend, with his trunk which leans forward, even with his feet, which contract in order to adhere more firmly to the ground.

Rowing is reputed to increase the size of the biceps, and this sport is generally classed with exercises of the arms. This is a mistake, for the work of the rower is far from being localized in his upper limbs. The muscular effort which moves on the boat is largely situated in the extensors of the vertebral column. The oarsman *pulls* above all with his loins. Further, when the boat is to be propelled with great speed, as in racing, the legs work at least as much as the arms.

The Oar and Paddle.

As we are writing these lines we are suffering from an attack of muscular stiffness produced by resuming the exercise of rowing after a year's interval. In the muscles of the arms we have merely a slight sensation of discomfort, but those of the loins and thighs are really painful, having been vigorously in action.

We must make a strong distinction between exercise with the oar and that with the *paddle*. In the latter exercise the canoeist derives a fixed support from the seat, and his legs do not help him at all. They usually lie in the bottom of the boat inactive and extended.

As to the trunk, it participates in the work, not by movements of flexion and extension, but by lateral displacements, now to the right, now to the left. Further, the canoeist, when making his most powerful efforts, is not leaning backwards, like the oarsman, but curved forwards.

This position is imposed by the necessity of giving to the movement of the trunk a

direction opposed to that in which the water is displaced by the motor of the boat. Now in paddling the water is displaced from before backwards, whilst in rowing it is displaced from behind forwards.

The canoeing movement is certainly very graceful. The body leans in regular rhythm to the right and to the left, and the head at each displacement is inclined in the opposite direction to the trunk, by a series of lateral inflexions of the cervical vertebræ. From these two opposed but compensatory movements, results a wave-like movement, which, added to the rapid gliding of the frail bark, forms a seductive picture.

A Curved Back.

But the canoeist's back is curved like that of the jocky, and his legs remain inactive. Hence, in our opinion, the inferiority of canoeing from the hygienic point of view. It leaves the lower limbs absolutely motionless, and it tends to produce a round back.

In rowing, the oarsman also leans forwards at intervals in order to carry his oar backwards, but this is at a stage in the exercise where no force is required and, therefore, no pressure is exercised on the vertebræ. The really energetic muscular action, the one which determines the progression of the boat, is performed by bending the body backwards; at this movement of the effort the head is high and erect, and if the movement is very powerful, the face is upturned. The really active movement in rowing consists in *extension* of the dorsal spine. No movement is more fit than this to remedy a round back.

It will be well to point out the difference between "sculling" and "rowing." In the latter case there is one oar held in both hands, which forces the oarsman to lean to the side of his oar. In sculling there is needed an equal and symmetrical effort of both hands. Hence, to preserve the straightness of the body, sculling is much superior to rowing.

We cannot review here all the exercises which are able to favor regular development. But we should like to try to define certain points which must be kept in mind when we wish to appreciate the influence of movements on bodily form.

Wrong Modes of Exercise.

First, the body left to itself, without being subjected to any external influence capable of producing deformity, tends naturally to develop in a regular direction. The causes which tend to produce deviation may be of internal orgin, such as affections of bones or joints, retractions of tendons or of muscles, and paralysis.

But the most common deformities arise from external causes, such as pressures, shocks, works or habits leading to a vicious carriage. Amongst the external agents capable of producing bodily deformity, ill-chosen or ill-directed exercise is a very frequent cause.

The vertebral column is the axis of the body. When it is normal in direction, the body is upright and the attitude is elegant. Most of the deviations of the spine have a muscular source, and arise from the predominant action of the muscles which draw the vertebræ in a given direction over those which should balance the action of these by drawing the spine in the opposite direction.

Muscular exercise tends to develop the muscles and the bones; it is enough that this development should be regular, that no region of the body should acquire an exaggerated size capable of destroying harmony of proportion, and that no portion of the skeleton should assume a vicious direction.

Neglect of all exercise sometimes coincides with deviations of the body, but these are almost always due to a habitually vicious carriage, such as is observed in persons of sedentary life. The schoolboy kept in class from morning till evening, the artisan kept all day in the workshop, often present deviations of the figure; but the vicious position of the body needed for writing is the true cause of the lateral curvature of the spine which is common in school children; similarly it is to the bent attitude when working with the needle that we must attribute the round back so common to tailors.

When muscular force is completely removed, as for instance in the dead body, there is a tendency to fall forwards; and if the dead body held upright is supported by the waist, we see the head lean down towards the chest, the shoulders fall forwards, and the back arched by an exaggerated flexion of the spine.



SPORT IN THE GYMNASIUM

This stooping attitude, due to complete absence of muscular action, is an exaggeration of that observed in persons whose muscles are extremely enfeebled by inaction.

The round back is in these persons always accompanied by a receding chest, first because muscular inaction leads to diminution in the size of the thorax; secondly, because



FIGURE 1.

in a side view of the body, very pronounced convexity of the back tends by comparison to cause the line of the sternum to appear flat, and even concave. We observe this characteristic deformity in all cases in which young persons have led too sedentary a life, deprived of air and movement.

Muscular exercise, in whatever form, gives marvellous results in these deformities in which we cannot properly speak of a deviation to be remedied, but rather of a weakened part to be supported. The vertebral column promptly finds energetic support from the spinal muscles as soon as a man begins to perform violent movements, for every work needing a certain expenditure of force demands action from these muscles for the purpose of fixing the vertebral column, the centre and pivot in all movements of the trunk and limbs.

But aside from these cases of excessive debility, it is not from increased strength of the muscles that we must demand the means of restoring perfect uprightness to the figure. The persons who are most remarkable for elegance and grace are often very *supple* rather than very vigorous.

Suppleness of figure comes from the great ease with which the vertebræ can glide in all directions over each other. From this great mobility results the facility with which the various pieces of the dorsal spine accommodate themselves to the different attitudes of the body, and to the rapidity with which the trunk is balanced in all the displacements which it undergoes. So that the greatest



FIGURE 2.

possible grace of figure may be observed in clowns.

Certain exercises which demand very slight expenditure of muscular force have a

remarkable tendency to make the back very straight: these are exercises which need balancing. A rope-dancer cannot keep upright on his slender support if he allows the axis of his body to fall out of the vertical, and this axis is represented by the vertebral column.

All the movements of the acrobat tend to give to the muscles which move the vertebræ the degree of contraction necessary that the bony rod they form should have a perfectly vertical direction.



FIGURE 3.

The rope-dancer preserves when on the ground the position which his well-disciplined muscles are accustomed to give to the bones on which they act.

Balancing jugglers are, like rope-dancers and *India-rubber men*, types of perfect physical straightness; and if we compare them, in the circus, to the gymnasts whose specialty is the trapeze, we are struck by the superiority of the former in elegance of figure.

We have seen nothing more charming than a little balancing girl who, at the circus, climbed to the top of a pyramid built of bottles, and poised herself like a bird on the neck of the highest without displacing any of them. It was marvellous to see the child

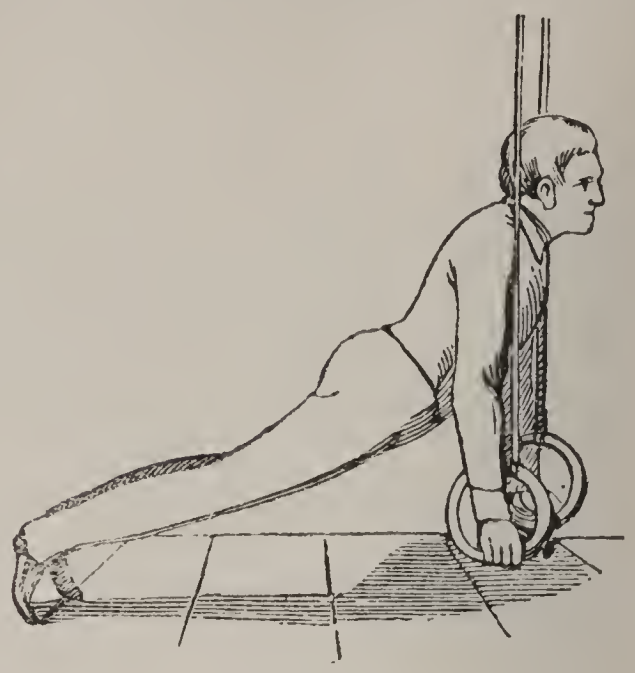


FIGURE 4.

when she had built the fragile structure, first make sure of the balance standing upright, then, putting her foot on its frail support



FIGURE 5.

raise herself, holding in her hand the neck of the last bottle, without the trunk deviating from the vertical by a hair's breadth.

It was then necessary, from the stooping

posture, to gain the upright one, and it was only by a mathematical precision in the con-



FIGURE 6.

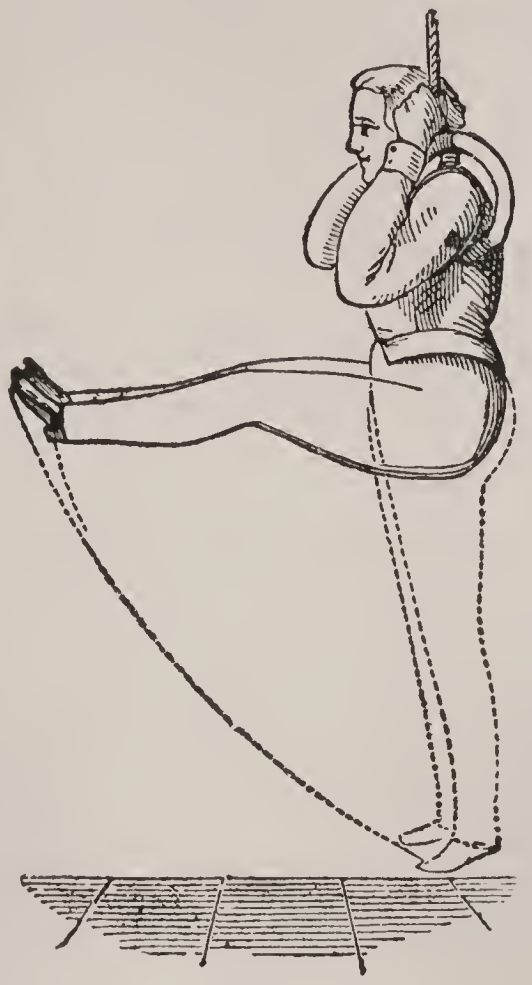


FIGURE 7.

traction of the vertebral muscles that the extension of the legs and thighs could be

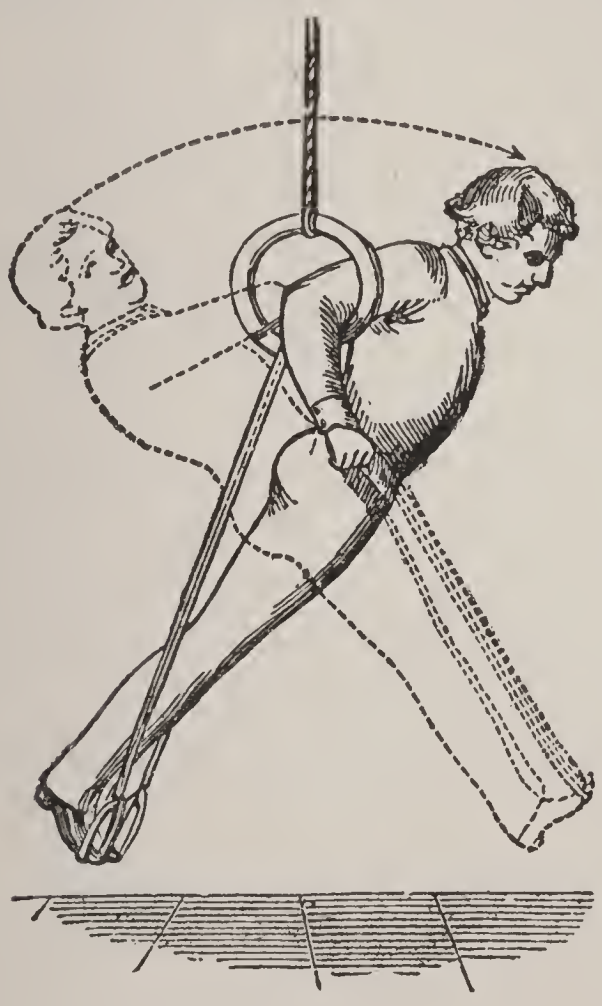


FIGURE 8.

effected without upsetting the whole structure.

It is our purpose to present the uses of the swing and stirrups, for they certainly possess the advantages of all other gymnastic apparatus. We would not underrate the value of other apparatus and modes of exercise. We offer the swing and stirrups, not as a full response to the public demand, but as the most complete "multum in parvo" in the gymnastic field, and as most admirably adapted to the wants of those who cannot avail themselves of the advantages of a gymnastic institution. To all such it is a God-send.

It is comparatively easy to devise gym-

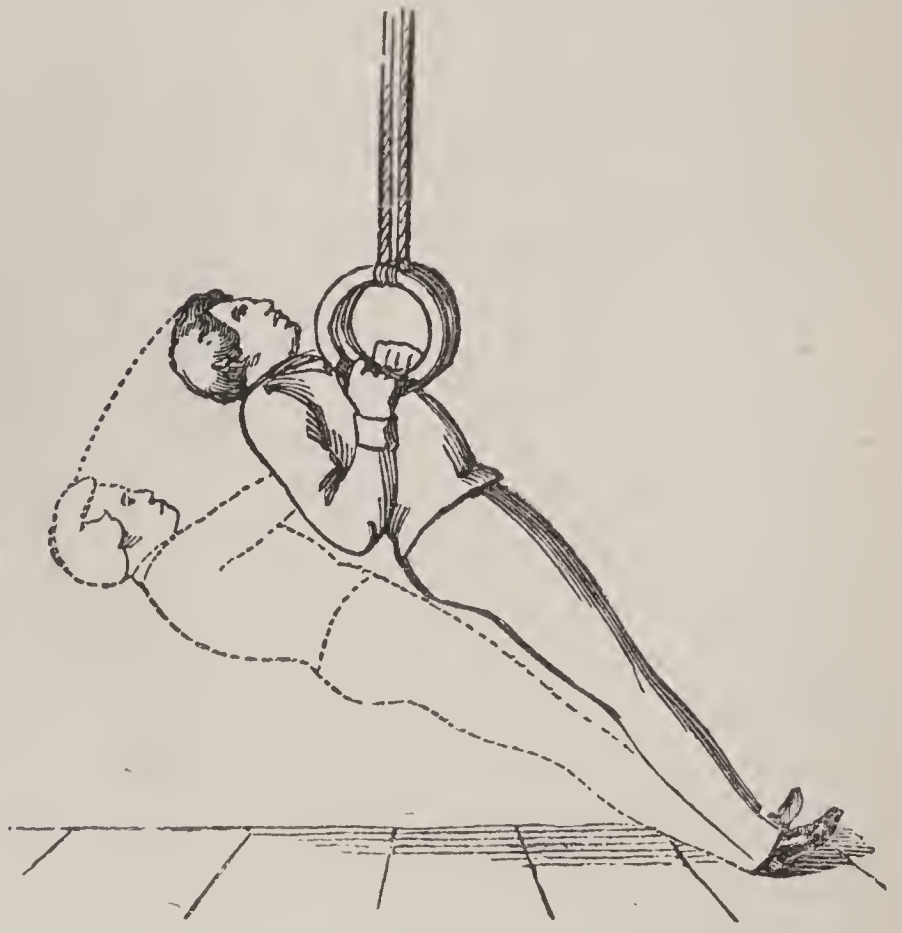


FIGURE 9.

nastic exercises which shall interest a social class, enlivened by music. But what shall those do, who, finding it inconvenient or disagreeable to visit the gymnasium, would cultivate muscle and vigor at home? In the absence of social stimulus and music, the exercises themselves must possess peculiar fascination. If, in addition, they bring every part of the body into varied action, giving the left arm, shoulder—the entire left half of the body as much and as varied exercise as the right, we should have the model home gymnastics.

The swing and stirrups meet these demands more successfully than any other apparatus yet devised. While the first exercises of the first series are simple enough for children, the last exercises of the last series are beyond the reach of all except those who have favorable composition and are very much in earnest. For clergymen, ladies and many others, who would carry on the work at home, this invention is the most complete means imaginable.

Two large hand rings are suspended from the ceiling by ropes, which, running through padded hooks, are carried to the walls. Two other ropes extend from the walls directly to the hand rings. A strap with a stirrup is placed in either hand ring. By a simple arrangement on the wall the hand rings are drawn as high as the performer can reach, or let down within a foot of the floor; or at any altitude they can be drawn apart to any distance. The distance between the stirrups and rings can be likewise varied.

The usefulness of the swing and stirrups depends upon the facility with which these changes can be made. The rings must be raised, let down, drawn apart, the stirrup straps changed, or removed altogether from the rings, each and all with a single motion of the hand and in a moment; there are various simple mechanical contrivances by which these multifarious changes can be made. An ingenious mechanic can scarcely be at fault. We will suggest that in splicing the ropes into the rings the splice should be long and drawn close; else giving way, an unpleasant surprise may occur; the ropes should run through strong, padded hooks at the ceiling, which are fastened on the upper side of the timber with thick nuts; the fastenings on the wall must be made secure.



FIGURE 10.

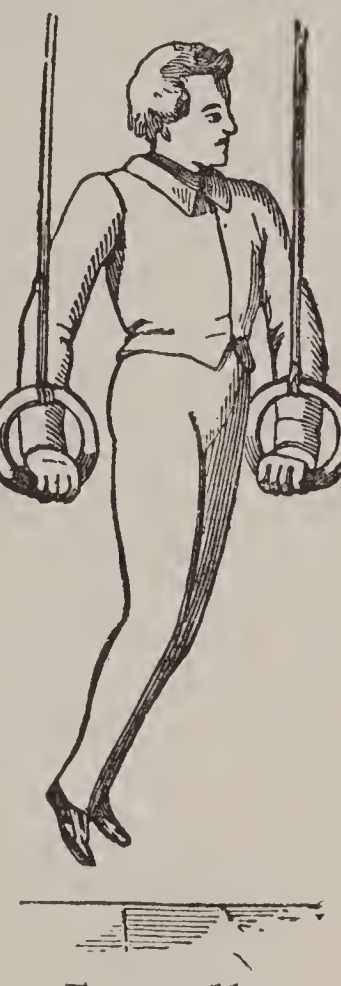


FIGURE 11.

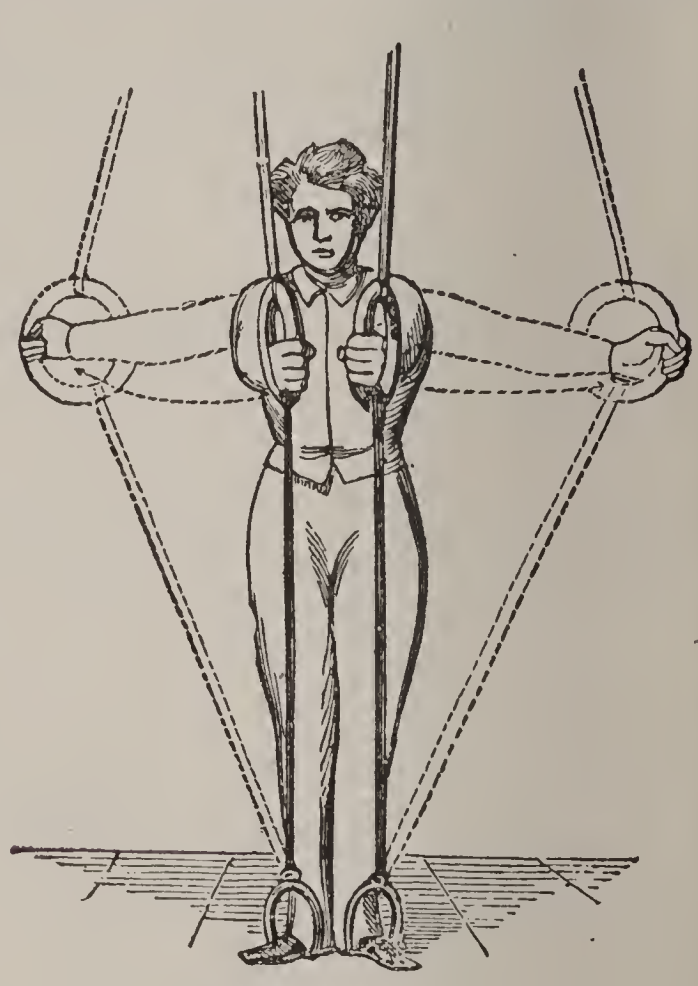


FIGURE 12.

The ropes with which the rings are separated should be armed with wrought iron snap hooks, which can be caught into wrought iron rings that have been firmly lashed into the suspension rope at the point where it connects with the hand ring.

The stirrup straps must be of very strong white leather, with edges so rounded that the pants will not be worn.

THE NEW MINT

AT

PHILADELPHIA.

Magnificent Building for the Uses of the Government—All the Appliances Thoroughly Up-to-date—Wonderful Mechanism for Coining Money.

THE new Mint which our Government has built for itself at Sixteenth and Spring Garden Sts., Philadelphia, is the handsomest and most complete institution ever dedicated to the manufacture of legal tender in this or any other country.

The building in appearance is an architectural gem, of long dignified lines, and happy proportions, and, fortunately, is situated on a broad thoroughfare, thereby giving the passer-by the rare opportunity of seeing the pile in its entirety from the street.

Huge foundry that it is, the artistic side has not been forgotten in the designs for the great building and such decorative work as has been used is placed where its effect on the visitor will be strongest.

Massive Bronze Doors.

Passing up the broad granite steps one is confronted by three sets of bronze doors, simple in design, but massive to the extent of impressiveness and swinging on their ponderous hinges they admit to the gorgeous mosaic-roofed foyer, pillared and arched, and containing the rainbow-like allegories typifying the art of coinage in its infancy.

Across the hallway is the grand stairway, with its big graven eagles guarding the way with outstretched wings, serving as a bridge from the atmosphere of art, which permeates the vaulted entranceway, to the plain, practical world beyond.

It is in these spacious, high-ceilinged rooms that the interest in the building lies; it is here that there is installed a mechanical plant that will outrival any money-making plant in the world, and represents the most up-to-date establishment of any sort built and operated by the United States Government

Electricity is the password for every appliance that knocks for entrance here, and nothing that will not lend itself to the energy of the dynamo can find a resting place.

The building is a gigantic bunch of electrical nerves, and the floors of the many rooms are tattooed with little brass plates which mark the spots where these vibrating nerves may be tapped to se-



NEW UNITED STATES MINT AT PHILADELPHIA

cure the power used in driving the machinery.

Independent Motors.

Every machine in the place has its own motor attached, thereby rendering its use independent of any other part of the system, making it possible to operate the smallest device, both night and day, without moving any other part of the system.

The motors range from one-quarter of a horse power to fifty-horse power, and are supplied by four engines, representing eight hundred kilo-watts. The engines, in turn, are operated by steam from eight boilers, connected with the engines by two complete pipe systems, which reduce the chances of a tie-up almost to an impossibility.

These boilers consume their own smoke, too, saving the waste fuel that usually passes off in black clouds from the tall stacks, and utilizes the exhaust steam from the engines for the purpose of heating the building. Here, too, electricity is called on to run the big fan that drives a torrent of cold air over a room full of steam pipes, so intricate and tortuous that they look like a giant's bowl of macaroni.

Electric Fans.

The air heated by contact with the pipes passes into the rooms, after which other electric fans draw it out, keeping the atmosphere of the building always fresh. The most powerful of the motors are to drive the big rolling mills which draw the gold and silver ingots down to the desired thickness for coining. The rolling mills to be used for this purpose are an innovation in the minting of coins, and will not only make the work of reduction more accurate but will turn out the thin metal strips more quickly than the old method, wherein the bars were drawn between two upright studs placed at a distance apart equal to the thickness of the coin to be stamped.

Then, according to the demands of the machine, the motors change in size down to those used on the delicate weighing machines brought over from Europe.

These scales are used to test the weight of the blank metal discs before they are stamped into coins, and not only give their exact weight but separate them into three classes—those under weight, which are melted over, those correct and ready for coining and the heavy ones that are taken to the adjusting room and filed down to proper size.

Quick Work.

Not only does this contrivance give us gold coins of a greater degree of fineness, but does the work very much quicker. The operation consists in placing the gold ingot in a porcelain jar filled with an acid solution parallel to a strip of pure gold, through which a current of electricity is passed. As the acid slowly dissolves the ingot the impurities, usually tin and antimony, fall to the bottom of the jar, while the gold is attracted to the strips of the same metal which is charged with electricity.

This process, known as the "electric," was brought from Germany by Mr. H. J. Slaper, superintendent of the refinery at the Philadelphia Mint, and was used in the old Mint for experimental purposes It entirely does away with the old process of dissolving and boiling, and will be placed on a practical working basis in the new Mint for the first time in this country.

As simple as it may seem, this method of refining is not without its drawbacks. The jars for holding the acid, which were made in this country, were not equal to the work, and it became necessary to import a lot of

twenty from Germany, the cost of which was $1200.

The lighting of the entire plant is by electricity, and so perfect are the arrangements that no provision whatever has been made for the use of gas. Notwithstanding this, a gas plant is being put in, which will furnish 25,000 cubic feet an hour. This will be used solely as fuel in the annealing process, instead of the coal and wood formerly used at the old mint.

Eight Elevators.

Eight elevators are required to handle the work which Superintendent Boyer is expected to do, and each one has its individual motor attached to its drum. One of these lifts is a massive affair with a capacity of eight tons, and is used to carry the heavy machinery to the upper floors.

The machine shop is a big establishment in itself, and will not only make the coining machinery used in the mint, but will be able to produce machinery for the mints of other cities. Here, as in the other departments, the lathes, planes and drills are run by motors attached to the machines.

In the matter of electrical signal systems the one used in the gold vault is unique. The entire compartment is lined with two layers of metal, separated just enough to prevent contact, and each layer connected in such a way that if perforated from the outside with a metal tool it would form a complete circuit and start bells enough to give a good imitation of a fire alarm in a small town.

The entire building is supplied with electric clocks, which are connected with a master clock in the superintendent's office, this one being connected with the system operated from Washington.

Although no effort has been spared to make the structure absolutely fire-proof, it was thought wise to be in a position to get immediate help in case of an emergency, and with that end in view an elaborate arrangement of electrical fire signals were put in, so that a fire in any part of the works could be detected instantly.

Watchmen's Clocks.

In all the principal rooms there are electrical watchmen's clocks, which register in the main office the presence of the watchman in that part of the building at a certain time, and, in addition to this, it is the duty of the guard to report "all's well" to the central station every hour of the night. Failure to do this within five minutes after the hour would bring a patrol wagon load of bluecoats to the mint in a very few minutes.

The new plant has a capacity three times as great as the old establishment, and in addition to the efficient methods of the old mint, has all the newest and best that the world has devised for the aid of the coiner.

That nothing might escape him, Superintendent Boyer sent a representative to Europe, where he made a careful inspection of all the principal mints. His report was in favor of our coinage plants, but what we lacked he brought over for the big place at Sixteenth and Spring Garden Streets, Philadelphia.

THE EARTH IS WEARING OUT.

Fertility of the Soil Diminishing—Phosphates of Florida—The World Ransacked for New Fertilizers.

BY this is meant the fertility of the earth, its producing capacity, and that more particularly in the two Americas and in the tropical and semi-tropical zone of the Old World. The Chinese and the Hindoos, though they rank among the weakest peoples of civilization, yet have shown conservatism in dealing with the earth's fertility which should shame some of the nations that have been murdering and looting in China.

Turned Into a Desert.

The ancient empires of Assyria, Persia and Palestine reduced the earth to a desert, for artificial fertilization was then unknown. Egypt escaped utter desolation, for her source of fertility, the Nile, remains unchangeable. Greece, Rome, Italy, and Spain, perpetuated barbarous abuses upon their soil resources, but they are slowly recovering their lost ground and rebuilding the fertility laid waste by their degraded ancestors of the Middle Ages. Italy, for instance, consumed in 1898 a total of 228,690 tons of commercial fertilizers, and in 1899 277,315 tons, showing a rapid increase. France imported in 1898, 187,676,000 kilograms of nitrate of soda; in 1900 she imported 240,787,300 kilograms. Of natural phosphates, in the two years, 133,405,400 and 249,188,000 kilograms respectively.

Commercial Fertilizers.

The earth is ransacked for new supplies. In Australia, previous to 1895, the use of commercial fertilizers was insignificant, being confined to a few gardens, for the bone dust was found heating, and in that arid climate this was injurious. But since that year the cool rock phosphates of Florida have been gaining ground, and in the year 1900 the colony of South Australia alone imported 22,082 tons. A surprising gain in the yield of wheat results; from the application of seventy or eighty pounds per acre the farmer receives an increase of eight to eighteen bushels per acre, sometimes even twenty.

The fact is, the vast majority of mankind, even of the civilized nations, are still in ignorance or only just awakening

to the value of artificial fertilizers. The Chinese have always been misers of fertility, and while they have practically no system of sewerage, they save the wastes of their cities by effective though offensive methods. Berlin has her fertilizer farms by which the wastes of that city are rendered a source of municipal profit. But the Anglo-Saxon nations continue their wasteful administration, by which the fertility of the world is poured in mighty streams down the sewers of England and America, as centuries ago it ran down the Cloaca Maxima of Rome.

Value of Fertilizers.

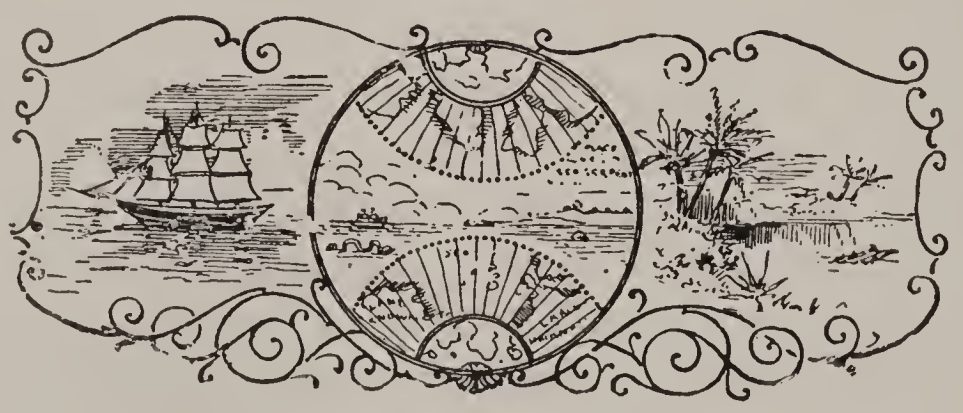
The Anglo-Saxons are the best farmers of all men, but the most destructive of their sources of fertility. We buy with money from the ends of the earth what the despised Chinaman husbands out of his own resources. What will the end be, when we can no longer ransack creation for fertilizers? It is not difficult to foresee

As a natural consequence of this increasing demand for fertilizers all over the world, there has been a sharp advance in prices. In the last two or three years sulphate of ammonia has advanced from $5 to $7 a ton; nitrate of soda, $3 to $6; dried blood, $7 to $11; high-grade blood and bone, $7 to $9; lower grades in proportion; cotton-seed meal, $2 to $3; sulphate of potash, $2. Acid phosphate and dissolved bone have advanced little, if any, but the demand for them is firm.

Growing Demand.

We might have mentioned the high price of cotton as another cause for this advance. Georgia alone expects to use fully 85,000 tons of fertilizers more a year than formerly. Other cotton growing States will probably not be behind.

The high ocean freights consequent on war are responsible for the rise in nitrate of soda. If the reported discoveries of immense deposits of this mineral on the Mojave Desert are confirmed, prices may ease off a little. But cattle products, blood and bone, etc., cannot well be lowered in price, for the earth has about reached its limit in pastoral resources.



AMERICA'S COMMERCIAL INVASION OF EUROPE.

What these American Products Are that have Recently Crowded Out Foreign Goods, and now find a market for themselves in the Countries that used to supply us—Something about these goods of American Manufacture and the Industrial Supremacy of the United States.

The conquering Briton who has been invincible both in war and in peace is at last terrified with the onslaught of American goods. Their great steamers once went away laden with merchandise and returned with such commodities as the English could not produce, but now their docks are lined every day with tons of American goods underselling their own in the home markets. Coal is being carried, as it were, to Newcastle and finding a profitable market.

An Englishman recently complained in Parliament that he arose in the morning to put on American clothes, eat an American breakfast, ride on American cars, do business on American goods, read American books, and thus fill body, soul and business on American products, all in the city of London.

He found that he was eating bread from the flour mills of Minnesota, meat from the packing houses of Chicago, wearing cloth-



The unloading of American goods at the London Docks. America's commercial invasion of England is a new order of things, and means our commercial supremacy as a Nation.

ing from the mills of Massachusetts, and reading newspapers made from the woods of Maine and printed on presses made in New York.

Primarily this state of things is laid to the superior economy and labor capacity of our machinery. Invention has overwhelmed old methods.

erpool, Sheffield, Woolwich and London, the home of metallic manufactories, are now supplied almost wholly with furnaces from America.

The great cotton mills of Lancashire are migrating to the Southern States, and the iron trade has gone to Pittsburg and the Southwest; three-fourths of the watches



A great lake steamer, the Northland, 386 feet long, draft 26 feet, tonnage 5,000 tons, carries 500 passengers, and is 7,000 horse power. This is the largest, fastest and finest boat that floats on inland seas. It is strictly the American carrier of American goods.

American Typewriters.

More than a million dollars worth of American typewriters are sold in England every year, and nearly all her telephones are furnished by the Western Electric Company of Chicago.

Half the motors for the British street cars are made in New York. Nearly all the pumps and soda water fountains used in the world are made in New England. Liv-

carried by English-speaking people are made in the United States.

The life and fire insurance companies of New York are doing almost as much business in England as in America.

The Standard Oil Company.

The Standard Oil Company long ago largely monopolized the production of oil throughout the world, excepting in Russia.

The great tobacco syndicate of the United States has invaded England, and the native companies have all combined and are selling tobacco to dealers at ruinously low figures in order to keep America out. Meanwhile, Mr. Duke, the head of the syndicate, went over to Germany and let the Englishman keep on selling at the low rates, while he bought up the factories in Europe.

in large quantities to European iron foundries.

The packing houses of Chicago and Kansas City furnish nearly half of the packed and canned meat of the world.

Iron Industry.

Lord Lytton in his romance, "The Coming Race" speaks of the American progress "in which Europe enviously seeks her



Coke ovens, showing furnaces where the coal is burned into the coke, and the means employed for conveying the coke from the ovens to the cars, ready to be hauled to steel and iron mills.

What is true of the invasion of England is true of almost every country in Europe worth invading, excepting Russia.

Our pork and flour has for years been the bogie-man of the German farmers. Its invasion there has precipitated some of the fiercest debates in the Reichstag and caused to be made some of the most stringent inspection and exclusion laws.

American steel has beaten down all competition of any importance throughout the world and even pig iron is now imported

model, and tremblingly foresees her doom."

It would seem ridiculous to speak of one firm as being a menace to Europe but such was the case when the Carnegie Company alone in 1900 produced more than two million tons of pig iron, which was equal to half the output of the world three decades before. It produced, also, that year more railroad iron than did all England ten years before when England was then making rails for nearly the whole world.

The Illinois Steel Company did as much

business as half the mills in Continental Europe and when all the great mills of the United States, more than a score in number, combined in the greatest corporation the world had ever known, their power over the iron industry of the world was overwhelming.

many achievements that could not be otherwise reached.

Coal Industry.

Emerson said that coal provides a portable climate, but more than that it gives the energy of commercial and manufac-



A miner knocking coal. This gives a good idea of the appearance of a vein of coal and how it is mined. The miner first loosens it with his pick, and then shovels it into the cart, which is drawn to the mouth of the tunnel and dumped into railroad cars.

Iron is the symbol of utility and the history of its use in civilization up to the advent of electricity is practically the history of the progress of the world. Intimately connected with its production is the use of coal which has made possible

turing power. In rough estimate nearly half a billion tons are mined and used yearly. Of this, the English speaking countries furnish more than half.

Several sensations have been created in England by the assertion of scientific men

that their coal supply was near exhaustion, but such a question is too far off to be raised in the United States. In ten years England increased her output about twenty per cent., while that of the United States



Down in a coal mine, showing the miners with lamps in their caps, and horses used in the work. Above them are shown the timber supports to prevent the mine from caving in. It takes a long while for both men and horses to become accustomed to working in these immense tunnels deep into the earth.

was more than doubled. At the beginning of the decade, England supplied nearly the entire Mediterranean trade, but three-fourths of it is now in the hands of American shippers.

West Virginia and Pennsylvania together have twenty-eight thousand square miles of coal beds and could probably supply the world with all its coal for half a century.

Canada has deep beds of coal scattered thickly over a hundred thousand square miles of land and yet it does not mine enough for home use. The great coal barges of the United States may be found on almost every part of the ocean, especially where there are naval stations to be

supplied. Without coal the great navies of the world are worthless and the vast range of commerce would come to an end.

Lumber Industries.

The vastness of the lumber industry can only be approximately appreciated by one who has imagination enough to realize the extent of the use of wood in manufactories and the building trades.

Far up in the forests of white pine strong men are sawing down trees, cutting off the limbs and preparing the great logs to be rolled into the rivers and floated down to the mills.

These great tree trunks are cut into rough planks or boards and sent to the planing mills. From these, they go to the lathes if they are to be wrought into fancy shapes for any special use.

When huge trees are felled at a distance from the mills or water's edge, a machine called the bull-donkey, with long steel cables, has been invented which draws from 60 to 100 tons at a load. This drawing power is simply ordinary light machinery fastened to the earth at the trunks of trees and a small engine supplies the energy.

For short distances down mountain sides, chutes are prepared to slide and guide the logs, but where several miles



Logging on the Menominee River in Wisconsin. In the distance are seen the saw mills. The logs are floated from the forests many miles distant down this river to the saw mills, where they are sawed into boards, shingles, building and furniture shapes.

must be traversed flumes are provided in which the log floats down through a stream of water. In some of these flumes the logs attain a speed of considerably more than a mile a minute.

The lumbermen are daring enough to ride down these flumes in small boats, but it is an experience which requires more than ordinary courage for the first trial.



A timber flume used for floating logs down the mountain side. They are constructed by turning mountain streams into wooden troughs. The woodmen often construct little rafts, and ride down these flumes at a rate of 60 or 70 miles an hour.

The Copper Industry.

Carefully prepared tables show that in the ten years ending with the year 1901, the United States produced more than one-half of the copper of the world. The ten years before, it supplied only one-third and in the ten years previous only one-sixth, while the time previous to that was hardly worth accounting.

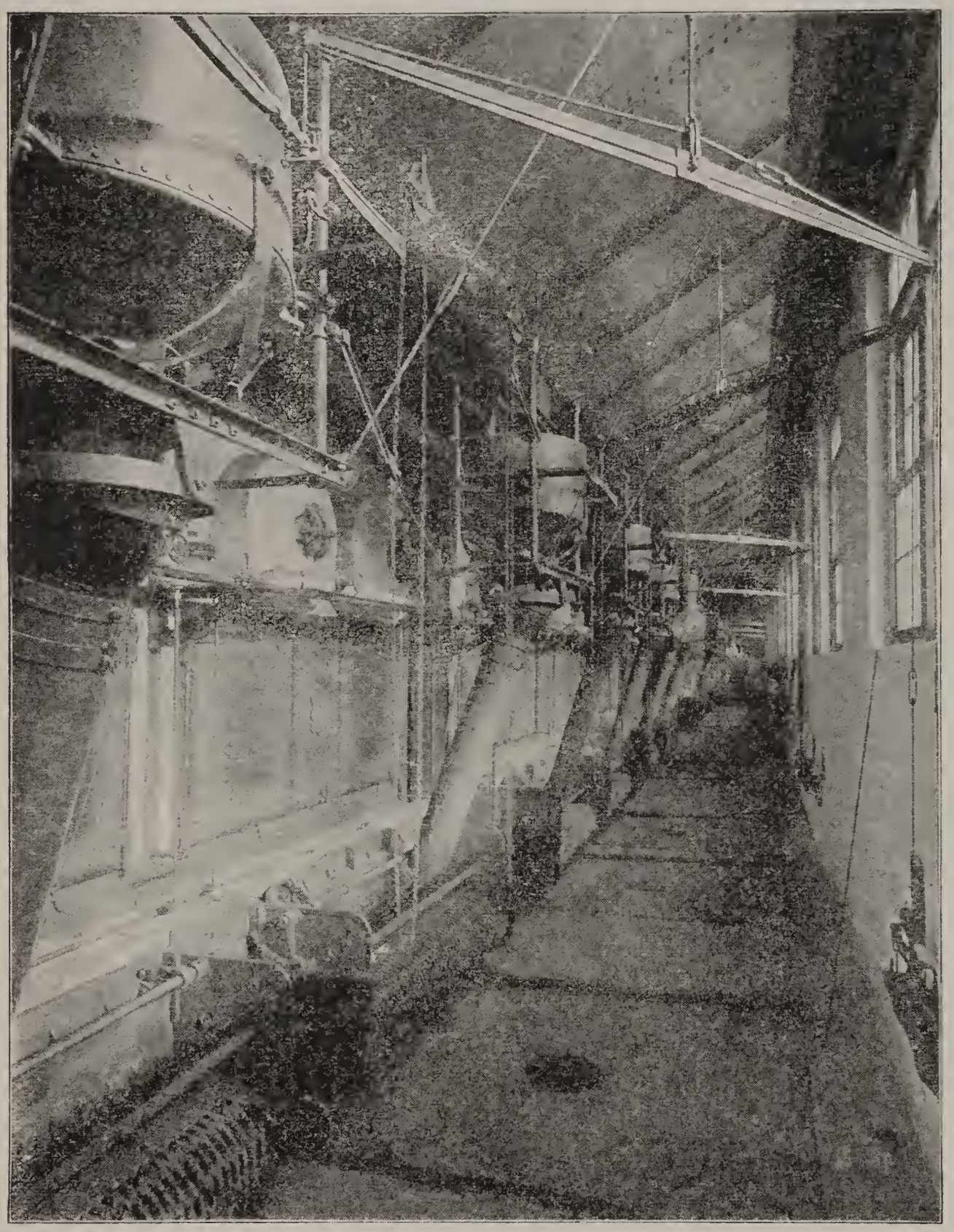
In thirty years the world's production of copper jumped from 91,000 tons to nearly four million tons, and the price meanwhile fell nearly one-half.

More than $100,000,000 worth of copper was mined in America in 1901, or more than that of gold, the Lake Superior and Montana copper regions being the greatest in the world. In the Lake Superior regions are to be found mines that were systematically worked long before the farthest backward reach of any attainable evidence.

The Red Jacket shaft of the Lake Superior district is twelve feet by twenty-five

feet in size and has been sunk to the depth of a mile.

The bullion copper is cast into slabs about three feet in length. The United



Self feeding furnaces. The coal is fed automatically from the top through the pipes onto the revolving grates. No firemen or other attendants are necessary. The coal is unloaded into the bunkers above, and the furnaces are allowed to take care of themselves.

Verde mine is through a bed of copper known to be two thousand feet deep with nothing to indicate how much deeper it may be.

The Calumet and Hecla mines employ 5,000 men of twenty-three different nationalities.

Tesla has predicted that aluminum would soon supersede copper and practically destroy that industry. Although its cost has been reduced to one per cent of its original production, and every clay bank is an aluminum mine, yet the rapidity and cheapness of production required has not yet been reached.

Electric Industries.

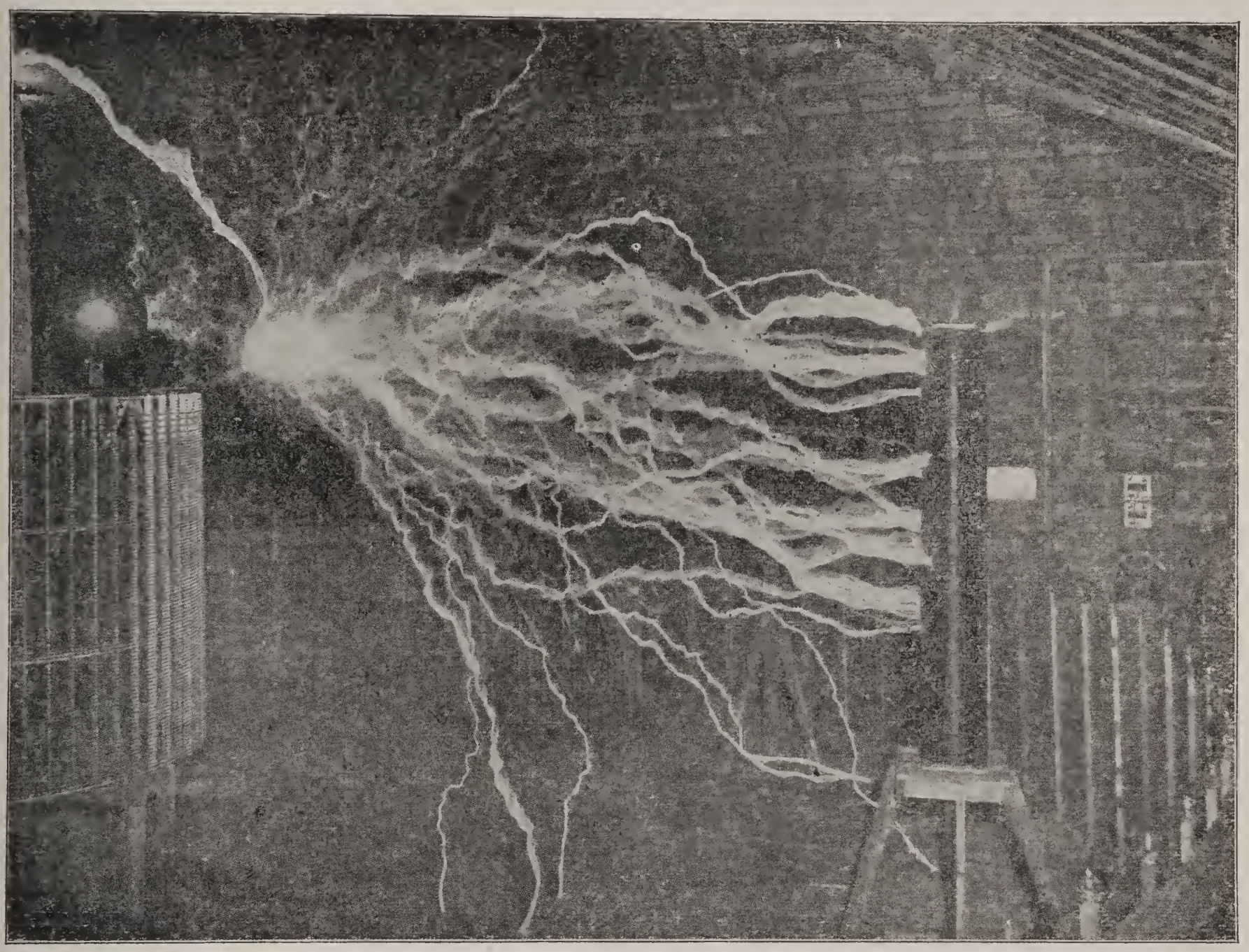
The manufacture of electric apparatus and electric appliances, with the general extension of electricity in the various industries, has been the commercial wonder of the latter half of the nineteenth century. From the investment of a few hundred thousands the production and use of electricity has spread into scores of enormous branches, each absorbing many millions of dollars, altogether amounting to untold wealth.

The use of electric energy has extended the power and knowledge of man a thousand fold in directions previously unthought of even by the most imaginative dreamers.

Not only in the industries but in the vitality of man, it has infused new strength by proving itself to be a germ and filth destroyer as well as a vitalizing force of which we only yet dimly know how to take advantage.

Electricity is to the human mind a perpetual paradox. It does things that are amazing beyond conception and then does not do them under apparently similar conditions that are equally amazing. A bolt of lightning has been known to destroy vast structures as though they were children's toys and again pass through others, leaving hardly a sign. Men have been struck dead, but others have had the iron in their pockets and shoes melted without the slightest inconvenience to them.

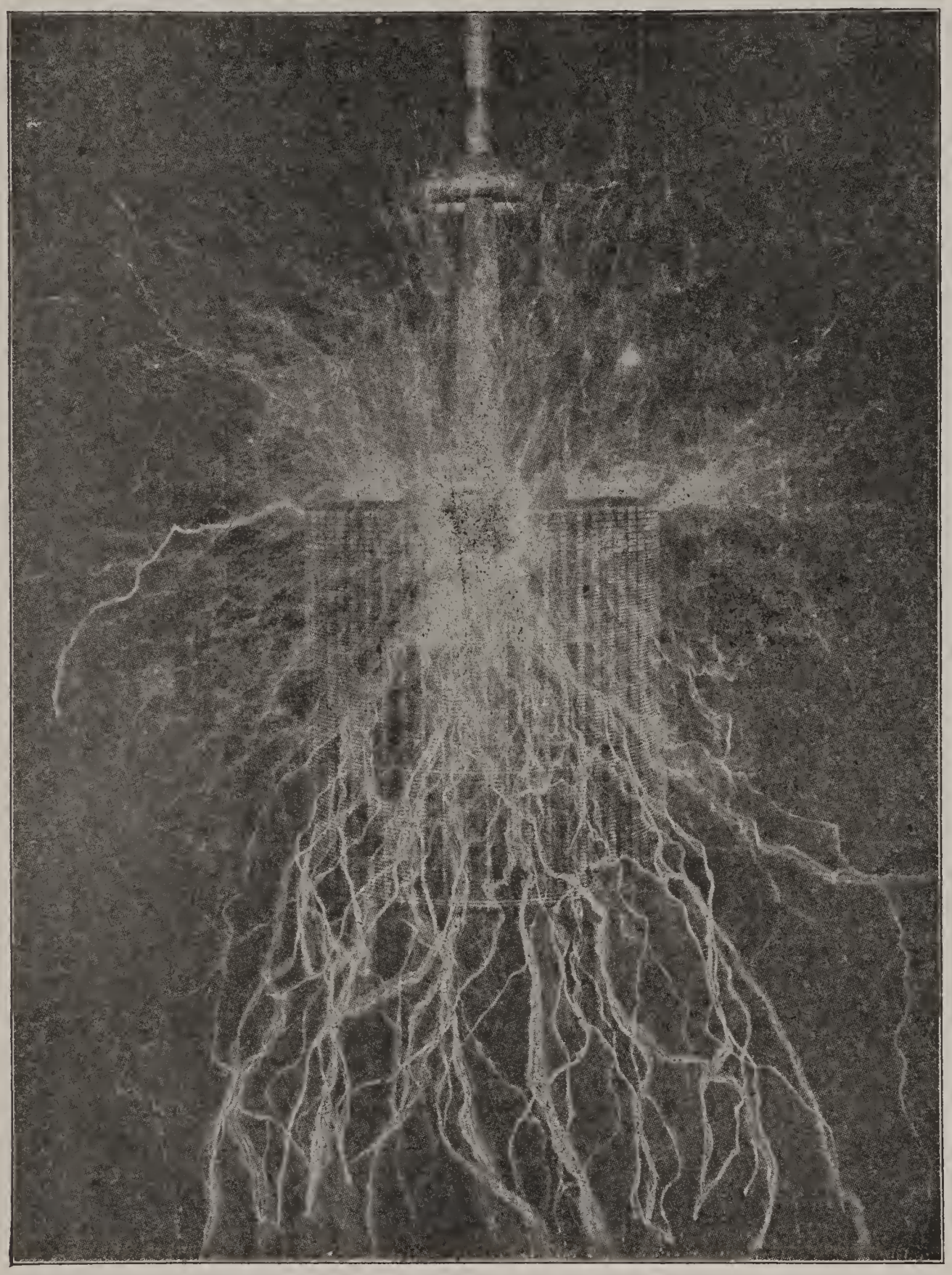
In 1890, Tesla, before an audience of scientific men, passed a current of electricity through his body, so powerful and intense, that it melted the conducting wires which he held in his hands without inconvenience to him. He has declared that he was not afraid to allow the entire force of the fifty thousand horse power dynamos of Niagara Falls to pass through his body. He has also discharged electrical currents across spaces in which the electrical heat was so great that pieces of metal were



Nicola Tesla's experiment showing the explosions of an alternative movement of electricity from the earth into a large reservoir and back, at the rate of 100,000 alternations per second. The discharge escapes with a deafening noise. This electrical explosion is of the greatest power yet produced.

melted, and yet in that space he would place his hand or head without the slightest hurt.

The result of Marconi's experiments in signaling across two thousand miles of ocean and of Tesla's in transmitting electric power through earth and air, makes it appear that we are on the threshold of discoveries in electric power that will in comparison make the discoveries of the nineteenth century seem insignificant.



An electric oscillator delivering energy at a rate of 75,000 horse power. The pressure is over 12 million volts. The width of the discharge is about 70 feet, and the surrounding atmosphere is heated to a high degree.

The Industrial Use of High Explosives.

The sudden liberation of tremendous energy is always fascinating if not terrifying.

The bolt of lightning that tears the mountain oak to pieces has ceased to be mysterious, but it never ceases to be exciting.

The liberation of great power, for specific purposes has become one of the greatest industries in the world. In the last statistics on the subject, the United States made nearly two hundred million pounds of high explosives valued at nearly twenty million dollars.

From the use of gunpowder, has rapidly risen chemical compounds of greater power, such as nitro-glycerin, gun-cotton, through to the recent terrific explosives known as melinite, emmensite, lyddite, cordite, jovite, and mercury fulminate.

An ounce of mercury fulminate will burst heavy boxes, ten feet square, composed of iron half an inch thick, though merely suspended by a thread in the center.

It will tear to pieces the hardest blocks of wood lying within a foot of this small bit of the explosive. When an ounce of it is fired into an iron cylinder filled with water, the iron is shredded into strings.

An accidental explosion of fifty-two tons of blasting gelatine at Braamfontein excavated thirty thousand tons of earth, two tons of dynamite at Fort Lee on the Hudson brought down a hundred tons of rock, two and one-half tons of gelatin dynamite



Photograph of earth thrown into the air by the explosion of a land mine of 600 lbs. of powder.

at Lambries, Wales, threw out one hundred and eighty tons of rock, and at Talcen, Wales, seven tons of gunpowder dislodged two hundred tons of rock. Probably the largest charge ever used was that in blowing up Flood Rock of the New York harbor in 1885. One hundred and forty-one tons of dynamite and mercury fulminate were used in one blast, completely demolishing a thousand ton obstruction.

In the industries, the use of high explosives have been perfected to the full extent of their usefulness, but in their use for war in defense or attack, they have not been made available for what has been expected of them. Although the tests made on armor plate have been marvelously destructive and the nations have expended vast sums in experiments, yet high explosives do not seem to fulfill their promise in warfare.

In 1897, at Indian Head proving ground, eight pounds of jovite sent a ten-inch projectile through a fifteen-inch Harveyized nickel-steel plate and it burst with terrific effect after passing through.

Guns of all kinds have been made to throw torpedoes and heavy charges of high explosives, but so far without satisfactory practical results. Theorists have assumed that when a gun is made that can safely throw these projectiles into ships, forts or armies, that war will be henceforth too destructive for human endurance and there will come the long-hoped-for reign of universal peace.

Many Kinds of Explosives.

The term "explosive" is applied to any substance that may cause an explosion by its sudden combustion or decomposition.

Gun powder, ordinarily so called, is a mixture of niter, charcoal and sulphur in varying proportions.

What are known as nitrate mixtures are made by substituting some other nitrate, as that of sodium, barium or ammonium for niter.

Chlorate mixtures are those that owe their explosive qualities to potassium chlorate, which is combined with a non-explosive but a combustible substance containing carbon and oxygen.

Nitro-glycerin compounds are what are known as dynamites, and are mixtures of nitro-glycerin, with an absorbent either inert like infusorial earth, or a combustible substance like charcoal.

Gun cotton is made by introducing the nitro compounds in place of the hydrogen in hydro carbons. This is one of the most powerful of explosives, and will explode in water as well as in air.

Picric powders. This class includes such of the nitro compounds as owe their explosive power to picric acid or a picrate.

Sprengel explosives consist of compounds whose components are non-explosive, but become explosive by the addition of oxidizing or combustible agents. All explosives of this class require a detonator.

Besides the seven different kinds of explosives above mentioned, there are miscellaneous explosives and fulminates that cannot be included in any grouping. They are of little practical value, and are used largely as fuses, safety cartridges, toys, etc.

Explosives will not explode in a vacuum, but if lighted, will burn slowly like any harmless combustible substance. Gun powder, if heated white hot in a vacuum, instead of exploding, slowly disappears without showing any spark or flame.



In the danger area of a factory that manufactures dynamite, cordite and other powerful explosives. Note the buildings surrounded by masses of earth, and each some distance from the other. They are constructed in this way to prevent a possible accident in one being communicated to the others.

The Society of Lower Animals

Compared to the Society of Human Beings. Great Multitudes Gather Together for Protection and Individual Comfort. Analogies and Relationship of the Higher and the Lower Orders of Society.

Great cities with their packed multitudes of human beings are duplicated all the way down the scale of life.

The vast order of flowers known as compositæ are but cities of flowers growing upon a single stem. Corals and sea-anemones grow in communities countless in numbers.



Seals on an island of the Pacific Ocean. In the foreground is seen a mother and her young.

In ascending the scale, there is a distinct visible separation, yet the unity is held even on up to human beings by invisible chains of heredity.

There are socialistic communities of ants all under one roof and in perfect order and discipline which are greater than London, Paris, New York and Chicago, all thrown into one. The lives of these little creatures are not simple as one would suppose, but exceedingly complex, as must be the necessity of such numbers in such close quarters. They have a complete military organization of defense against more kinds of enemies with more kinds of power for evil, than human beings ever dreamed of. From such military organizations comes differences in ranks and commands. As a result they have slaves in various states of servitude. They have specialists of greatest skill in mining, masonry and carpentry. The neuters of the red ant go forth in battle array in perfect order to a neighboring city having fewer soldiers, capture it and carry away all the eggs and larvæ which are carefully nurtured for a generation of abject slaves. There is a species in Texas which cultivates a species of small plant having a

sweet juice and another breeds herds of a peculiar insect which secretes a milk that they esteem a great delicacy.

The communal nature of bees is more familiar because their service to man has caused them to be more studied and written about.

Schools of fish do not seem to be held together so much by any mutual help or social instincts as from the greater chance of escaping enemies.

The higher up in the scale of life, the more benevolent are the social bonds of all animals that live in communities. A study of these communities or cities of insects, birds or beasts, presents endless series of wonders. When we come below what we call reason we give the strange guidance of these animals the name of instinct. But neither reason nor instinct can be made to account for many things connected with numerous feats performed by some of them.

The Salmon Fisheries.

For instance, how can the salmon hatched alone in the wayside pools of the Columbia river and its branches, all go regularly to a certain island every year far north in the Pacific ocean and return as regularly to their place of birth, there to breed and die.

These mysteries, including the strange life nature of the salmon, have occupied the attention of experts in the service of the United States government for many years,



Sport in India: A monkey chase.

notably among whom is Mr. Cloudsley Rutter of the Fish Commission at San Francisco, who has written a book on the strange episodes in the life, migration and return of this remarkable and useful fish.

Fortunately for the great salmon fisheries, as well as for the food production of the world, these marvelous creatures succeed in traversing the rivers of their birth down to the sea and across a wide stretch of ocean in countless millions, to one special spot, where they are caught, canned and brought back for the use of man in thousands of tons every year.

The Alaska Improvement Company has control of the largest fishing output in the world. Their head station is at Karluk, Kadiak Island, where, at almost every haul of the seine they take in as much as one hundred and twenty-five thousand pounds of salmon. In 1896 they took in at one haul of the seine a record-breaker of one hundred thousand five-pounds salmon. Some of the nets or seines used are nearly a mile long. The fish are lifted into boats, carried to the cannery and turned over to Chinamen who prepare them for the cans. One picks up the fish and throws it before another on the bench. He chops off its head and passes it to the next, who cuts off the fins. This one slits it open and it goes to the next, and thus till it goes into the can. A constant stream of fish runs all



Cutting blubber from whales captured off the northern coast of Sweden. The smoke is from the rendering factories. The sea-gulls swarm about, attracted by the disagreeable odors that infest this place.

day long upon this table, each Chinaman, like a machine, doing his part.

After the canning process is done, they are loaded into small cars and run into ovens where the first process of cooking takes place.

Preparation for the great fishing season begins in January in San Francisco. Some Chinaman boss undertakes to furnish the required number of coolies to do the canning at about eighteen cents a case.

Many tons of tin plate are needed with which to make the cans and many thousand bales of "shooks" or material for the boxes or cases. Coal must be procured to supply the fleet of ships used in transportation, and the boats' supplies are many tons of rope, thousands of square yards of sails, and other countless ship supplies.

The first ship starts north early in March. The canning does not begin till at least twenty-five tons of fish a day are caught, as anything less is not worth the trouble.



Polar bear on the ice. The Polar bear is one of the few animals that remain white at all seasons of the year. Its thick white fur adapts it to its surroundings.

The Chinamen are obliged to dispose of the day's catch, according to contract, before the day's work is done, and frequently that requires twenty hours' unceasing work. The average hours of labor is said to be eighteen.

It usually requires two months to load the ships with the cans of the summer's catch. The work of the Chinamen being ended with the last catch of fish, they are counted to make sure that all are leaving and are stored in the hold of the ships like so many animals and are returned to San Francisco. They are not regarded by their employers as having any human rights, and in the dangers of a storm at sea the hatches are usually fastened down to prevent any trouble from them.

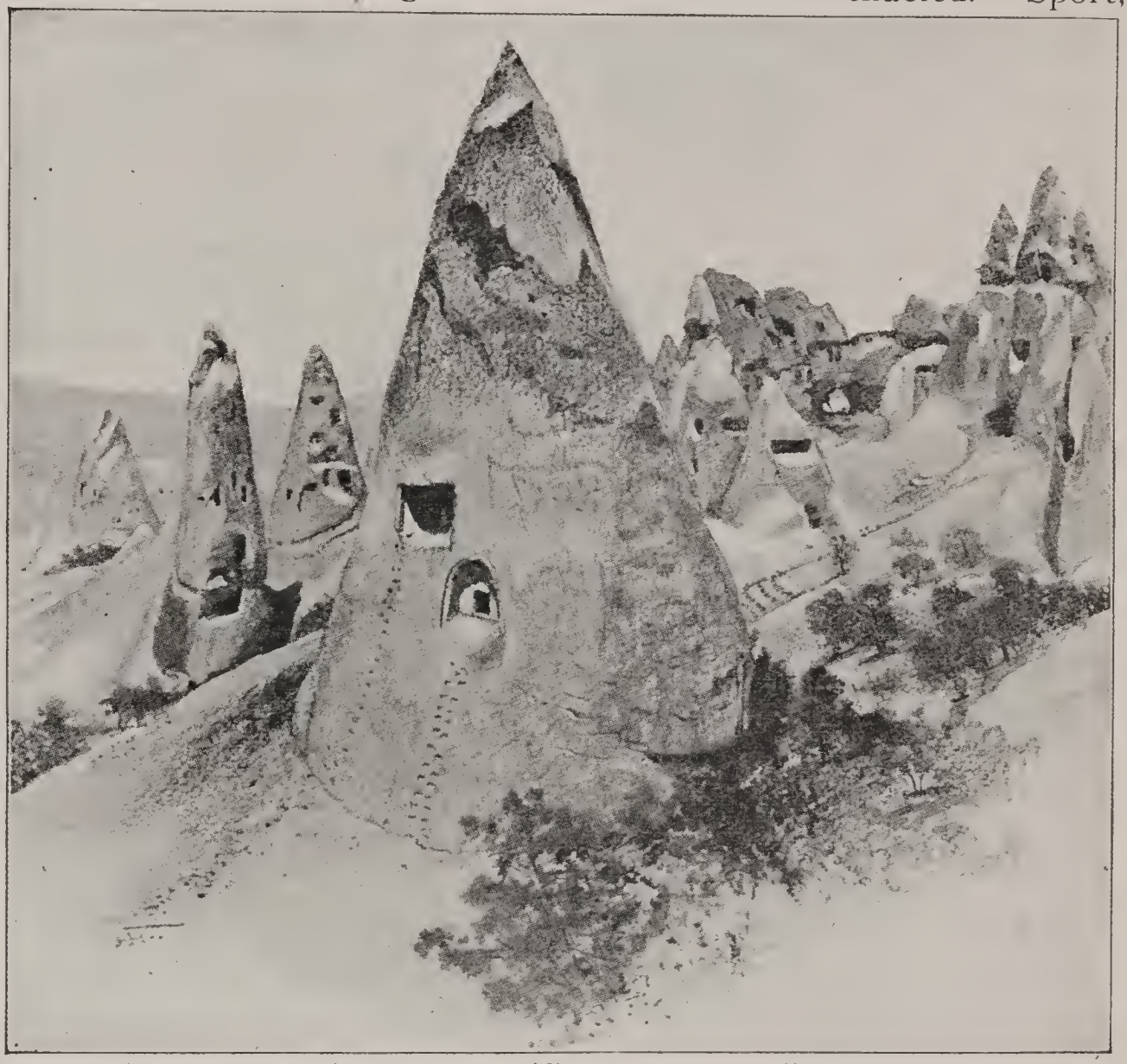
However, it is through the cheap labor of these coolies that the great fishing monopoly of the North Pacific ocean is able to send shiploads of canned salmon to the tables of the old world and to supply a large part of the bill of fare to the armies scattered over the world.

Fur-Bearing Animals.

Not far away in the Pribilof Islands are the famous resorts of the fur seals whose preservation has been cause for much international discussion. The fur seals are polygamists and have homes where the male, on a higher rock near by, watches over his family. He possesses his home only by superior strength, as much of his vigilance and power is required to drive away less fortunate rivals so as to save his family from the approach of other enemies.

The unmated males are always in a bad humor and are the ones ready to attack whatever they can find that will give them an excuse for a fight.

Many colossal fortunes have been made in the fur trade, and, to prevent the extinction of fur-bearing animals, the most stringent laws have been enacted. Sport, fashion or some special occasion may in a season almost exterminate certain species. Thus the coronation of King Edward VII. has nearly annihilated the ermines of Canada. An army of nearly a thousand men spent a year in hunting them down in the great northern forests in order that there might be no lack of ermine robes for the coronation.



Scenes from the troglodytes, or cliff and cave dwellers, in Persia. The great height of the cones in which these primitive people made their homes may be appreciated by comparison with the trees at the base. The notches in the walls, or ladders by which the inhabitants climbed into their homes, are still well enough preserved to be used for that purpose. This village is in the neighborhood of Martchan.

Most of the insects, birds and larger animals that live in communities have their homes in natural formations in the earth, while many like the ant, the cliff-birds, beavers and prairie dogs make their own homes in the most accessible and protective places.

All of these may be classed as troglodytes or cave-dwellers, as distinct from those animals that live in the open or in trees.

Man as a Cave Dweller.

There is sufficient evidence to show that man was himself once a troglodyte; that is, a dweller in natural formations of earth not shaped or made with his own hands.

In the Taurus mountains there is still a race of cave dwellers tallying close with the home-life of the extinct cave dwellers whose ancient homes are so numerous in various parts of the world. In the bluffs of the Bakluzan Dere are many hundreds of abodes approaching close to the types of primitive man. The village of Lerai is composed entirely of natural cavities in the rimrocks of the bluffs.

Not the least interesting remains of the human troglodytes are those in the canons and high cliffs of Colorado and Arizona. This region now so arid and barren was once teeming with a race of highly civilized beings. Perhaps there is nothing in all history so full of romantic speculation as the story of that race. It is an exhaustive day's labor to reach many of these cities from the base of the cliffs. Why they lived in such inaccessible places so remote from food supplies is an unanswerable question.

America has had a civilization, now almost wholly lost to human knowledge which may have been more populous, old and advanced than that of the Euphrates or of ancient Egypt.



Female Gorilla and Her Young.

The Gorilla

Inhabits the western Central Africa, and more closely resembles man in its form, size, habits and social instincts than any other animal. Its arms are longer and much stronger than man's. Gorillas are found living in communities or villages. They seem to realize that not only does this lessen the labors for existence, but that the motto of the human family "In unity there is strength" holds good in the animal kingdom.

STRANGE TYPES OF MEN

INHABITANTS OF THE FRIGID ZONE—THE PECULIARITIES OF THE UNCIVILIZED INHABITANTS OF THE REMOTE REGIONS OF THE EARTH.

It is easy to understand why men may live in the heat of the torrid zone because it requires so little energy to live, but why whole races should prefer to live in the regions of perpetual cold, is beyond reasonable answer. When brought into temperate regions, they are miserable, unhealthy and discontented. The barren bleakness of the frozen zone is the only place congenial to their natures. Their average intelligence compares favorably with the low types of men everywhere, but it appears to be impossible for them to rise much above the grade of life about them.

The Yakuts of Siberia are the only inhabitants of the frigid zone known to have a keen instinct and desire for trading. On that account they have been called the Jews of Siberia.



A bride and groom of Alaska. The bride is fifteen and the groom is twenty-three.

His national social characteristic is embodied in the saying, "Eat well and grow fat; you can do no better."

With this as the chief standard of life, it is not so hard to see how the Yakuts can live happy in their restricted limitations. Lieutenant Perry says that his first view of the interior of an Eskimo home filled him with loathing and disgust, but when the merciless rigors of the cold forced him to occupy one for several months, he forgot the palatial homes of the warmer regions and felt nothing but gratitude for the safety afforded him in the furs and shelter of the narrow hut. In height barely enough to allow one to

stand erect, about ten feet in the widest diameter, and with nothing but blocks of ice or stone for furniture, there would seem to be among those people the simplest and most primitive form of present human life.

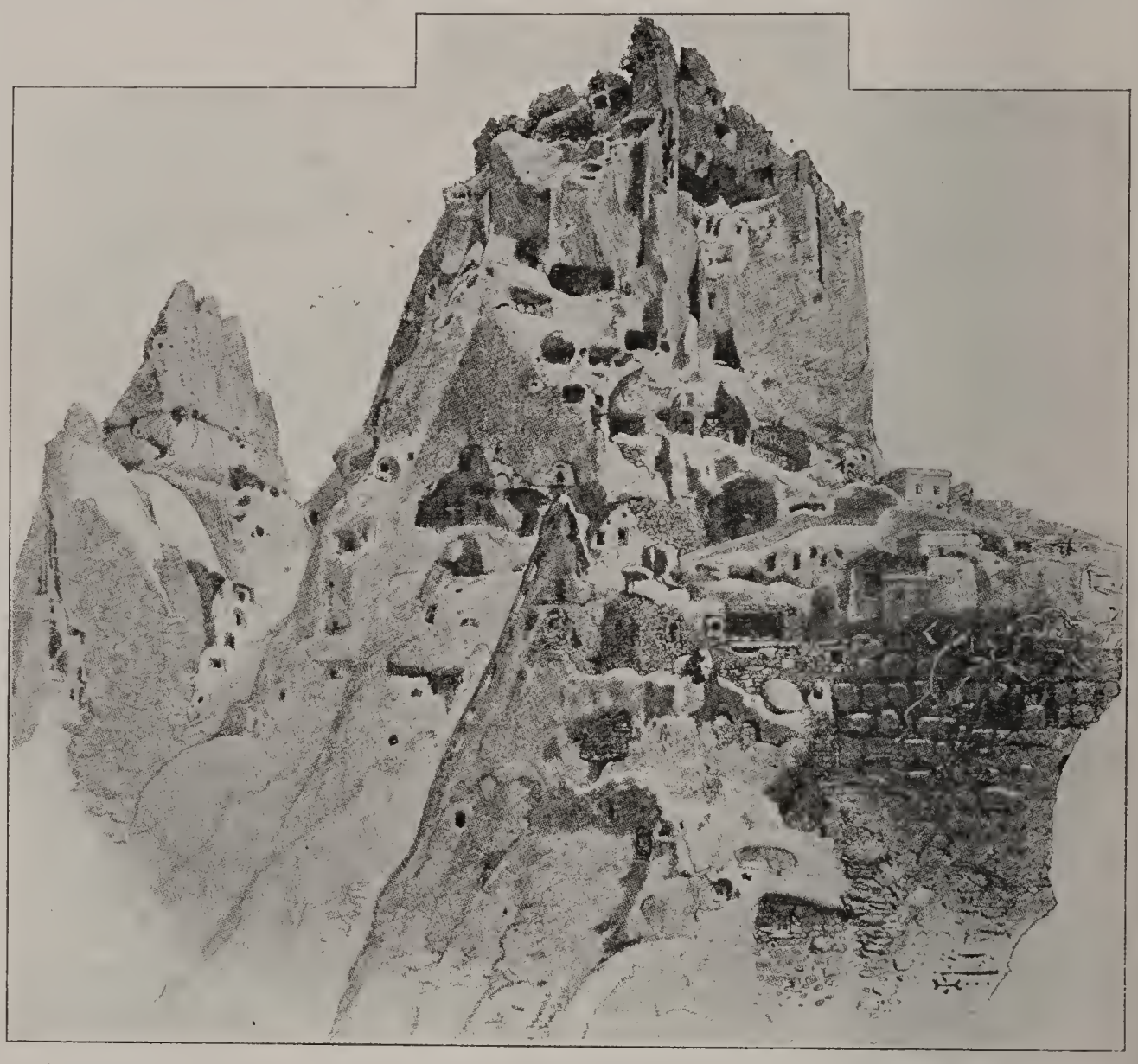
Their social instincts are, however, very similar to those common to all civilization. The women and men strive to win each other's admiration and the highest ambition of the man is to be thought more powerful in some way than his neighbors.

They have the curious custom of having a visiting season which begins with the first consolidation of ice in winter, just previous to the hunting season. Then the greatest hospitality prevails and there is a curious activity among them from the youngest to the oldest. It is the love-making season and most of the marriages then take place, the eligibility of the girls beginning at twelve years of age and that of the males at about sixteen.

When the Arctic highlanders, as those living in the highlands of Greenland were called, were discovered by Sir John Ross in 1818, they were amazed to learn that there were other human beings in the world. They believed themselves to be the only inhabitants of the globe.

If the earth cooled off first at the poles, according to the theory of geologists, and man first appeared there, then the Eskimos are remnants of our first parents, remaining nearest the original home. But it can hardly be asserted with any confidence that their origin can ever be known.

Their delicacies of food are not fat and blubber, as has been popularly supposed, but unsalted raw lean meat. They care little for fish, but like especially the hard gristle and cartilage of animals. It has been supposed that such a diet continued for countless generations would develop tigerish, wolfish traits in man; but, on the contrary, they are a very mild and amiable people.



Village community of troglodytes in the rock-cliff, known as the palace or castle of Udj near Assaru, Persia. It bears a close resemblance to the homes of the cliff dwellers in Arizona and New Mexico, showing the same development of instincts, though on opposite sides of the world. The village shown here is a little advanced over the cone homes at Martchan. Defects in the walls are, at this place, remedied by masonry, with some idea of architectural design.

They have customs but no laws or gov-

ernment, the oldest man of the household settling most disputes as a kind of judge. They have no doctors or priests, unless the one who sings songs and keeps the patient awake till he claims to be better, can be called a doctor or spirit adviser, for the songs are to drive away the evil spirits of disease, and may thus fill the office of both doctor and priest.

the northern regions will be as fully explored as any other part of the earth. Strange discoveries have long been promised by theorists when this takes place. So far these prophecies have been only the promises of theories, but Sergeant Julius R. Frederick, one of the heroes of the ill-fated Greely expedition of 1880, to the North Pole, has startled the scientists by re-



GREELY EXPEDITION IN THE ARCTIC REGIONS

As days and nights are so many months long in their country, the people have no regular time for eating or sleeping. They eat or sleep as they feel the desire to do so. Each expedition of white men into their territory makes more substantial their means of life, and they are more able to assist in the efforts to reach the North Pole. The time cannot be far away when

asserting the old theory that the region in the immediate vicinity of the North Pole is tropical in climate, vegetation and animal life, with a reasonable probability that human beings may be found there.

Many romances have been written on this theory and Sergeant Frederick offers many verifications of the theories of Captain Symmes and others, who have argued

so plausibly that when the North Pole is found there will be one of the most sensational discoveries of all time.

The assertion is made without reservation by Sergeant Frederick, and it is supported by numerous photographs taken during the special trip made from the Winter's camp toward the north.

He found remains of villages, indicating that they had been abandoned ages ago. From the nature of the architecture he inferred that they had been built by a race greatly superior to the present Eskimos. He found vast regions of petrified forests, indicating a luxuriant vegetation that had once flourished there.

He was within 394 miles of the pole, and his telescope enabled him to see 80 miles nearer. It was all land and the temperature had become two degrees warmer for each sixty miles they had neared the pole beyond the 81st parallel. Vegetation became more common and large, game of all kinds was more abundant. Animals and birds appeared that had not been seen for several hundred miles back. They found fresh water trout and many other evidences of warmer climate. The aurora, or northern lights, became so fiercely bright as almost to blind them.

His experience seems to uphold the theory of a warm zone about the pole, occasioned either by its being thirteen miles nearer the center of the earth than the equator, or from the fact that the earth, being a great magnet, causes streams of electricity to flow through, which keeps those regions heated. Such has been advanced to explain the northern lights.

In any event there remains enough mystery about this unknown portion of the earth to make it remain an interesting thing till discoverers have visited it.

The Polar expeditions starting this year on different routes may solve the mystery.

The Mysterious White Indians of New Mexico.

There is an ethnological mystery which has baffled speculation for more than fifty years, in the tribe of white Indians, which lives in the most inaccessible part of New Mexico.



A Navajo Indian blanket weaver, showing the frame supported against the side of the house in which she lives.

They were discovered by one of the numerous exploring parties sent into that territory soon after its acquisition from Mexico.

One of the curious conjectures advanced by some European ethnologists is that the white Indians found in the native village

of Zuni were the descendants of a Welsh expedition which is supposed to have landed on the New England coast some ten centuries ago, and to have worked its way across the continent almost to the Pacific.

Apparently it did not occur to any of these "wise men of the east" that there was anything incongruous in a supposed journey afoot for more than 2,000 miles across an unknown country, in the face of more or less opposition from half a hundred different Indian tribes. They produced a considerable number of words and phrases in the Zuni language which were almost identical with terms used in Wales as evidence of the relationship. Physicians might infer that the white Indians were albinos, but there is no definite evidence to support that inference any more than the other.



A Chinese Marriage Procession, with the Bride in the Enclosed Sedan Chair.

On account of the disinclination of the white Indians to expose themselves in the daylight, few white men have seen them.

In every way, save in the color of their skin and hair, the white Indians are the same as their copper-hued brethren. Their skin is of a dirty white color—dirty, of course, because of generations of uncleanliness.

Their hair is a tawny white, although otherwise they have the appearance of the normal Indian. They cannot expose themselves to the sunlight without becoming badly sunburned, and they do not tan, as most white men do in that land of everlasting sunshine, but their skin becomes red and inflamed, like the arms of a man who has taken his first swim of the season in an abbreviated bathing costume.

The eyes of these abnormal Indians are even more sensitive to the light than their skins, and when out of their houses these unfortunates go squinting through their closed lids to the right and left. At night only are they comfortable in the open air, and in the daytime they haunt the semi-darkness of the interior rooms in the huge hive-like clusters of houses which form the village.

That they are some strange mixture of Indians and another race can hardly be questioned, but what that race was is not likely ever to be known.

ATHLETIC DEVELOPMENT AND FEATS OF STRENGTH

THE GREAT POSSIBILITIES OF THE HUMAN FRAME AND MUSCLES UNDER CAREFUL TRAINING AND SYSTEMATIC EXERCISE.

From the days when the Greeks in sculpture, if not in fact, furnished the most perfect specimens of physical development in man and woman, and when Rome furnished the most powerful athletes, the



Mountain climbing above the line of perpetual snow, showing the perils encountered.

culture of the body has flourished everywhere alongside the culture of the mind.

"A sound mind in a sound body," has been the standard of personal well-being the world over, and there is no question that each is a powerful supporter of the other. When health and sanity alone are aimed at, there is little general interest in athletics, but in performances of feats of strength the public never tire.

It is related that one of the minor athletes of Rome laid a wager that, if he were given a year in which to train, he would carry a yearling bull of average size around the great arena three times in one day.

He immediately made an apparatus fitted to distribute the weight proportionately upon his body, and placed therein a bull calf, which he proceeded to carry around the arena morning, noon and night for the coming three hundred and sixty-five days, while all Rome applauded his perseverance and his developed strength.

No less exacting is the training required for all feats of agility, such as are performed in the circus arena and on the stage. Often the most difficult feats appear to be the simplest. Also, it frequently happens that many of the feats are greatly exaggerated by tricks and by mere optical illusions. Nevertheless, most feats of astounding agility or strength performed openly before the spectators permit of no deception.

Sandow was accustomed at every performance to support upon his back, upheld by hands and knees, a plank upon which were a horse and two ponies.

A German athlete, who has never left the continent, is accustomed to lift from the floor upon his bent back a piano with its performer, who continues uninterruptedly to play while being carried about the stage.

Human pyramids, consisting of men

standing on one another's shoulders, were once used in war to scale the walls of the enemy. There, when backed up against the wall, five or six men high, was no uncommon feat, but to stand in the center of the stage, four men high, is one of the most difficult and powerful athletic feats. Only three men high can be built up from the floor.



This picture is of Niagara River above the Falls, and shows Mrs. Taylor, the only survivor of a trip over the Falls, in her barrel.

Feats of balancing have always been popular and tricks on the tight wire will always afford a living for the expert.

Precision is required in all feats and mental calculations are made to a nicety, as, in extinguishing lighted tapers in the midst of a long leap, jumping in and out of a row of barrels, etc. John Higgins, a circus jumper, often reached a height of ten feet and a distance of twenty feet with no aid but dumb bells.

Marvelous stories of the ancients that surpass modern athletes may be classed as myths, since there is no evidence to show that muscular development was ever greater than at the present time.

Feats of daring have always won applause and wonderful examples were plentiful in ancient times, but they were not so combined with trained skill as at present.

Riding the turnover loop on a bicycle, or racing around tub-like structures placed on the stage, have become familiar sights at pleasure grounds or in the variety theatres. The skill and daring required is a matter of thrilling wonder for a moment or during a few turns, but its comparative safety palls after a few exhibitions.

No place in the world has been the scene of so many disasters and of such truly marvelous feats as is that of the Niagara Falls. Climbing the Matterhorn or reaching the topmost points of any of the shaft-like peaks of the Alps, has been regarded as the highest feat of human endurance and courage, but it has not the terror of uncertainty which unnerves even the strongest in contemplating the feats done at Niagara.

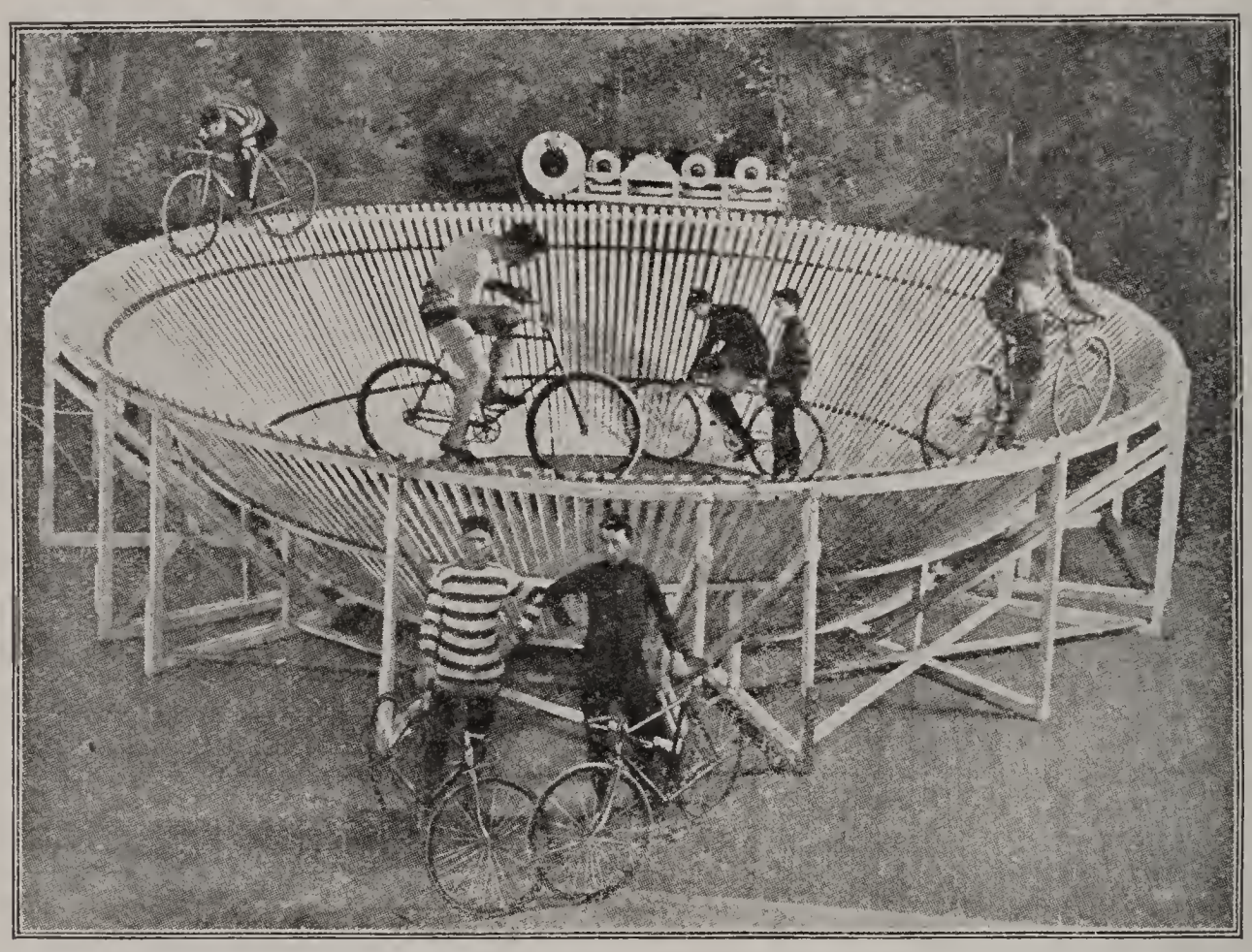
Many women have climbed the rock-steeple of the Matterhorn and many others have lost their lives in the attempt, but the element of chance and the terrors of uncertainty enter but little in mountain climbing.

To a woman, Mrs. Taylor, belongs the credit of being the first and only person ever to go over Niagara Falls and live. On

Thursday, October 24, 1901, she entered a barrel constructed for the purpose, was towed out into the river above the Horseshoe, and set adrift. There was first a perilous descent through the reef-filled rapids of fifty-five feet and then a drop of one hundred and sixty-five feet into the lower river. She was taken out of the barrel thirty-five minutes after entering it, much shocked and bruised, but with no serious hurt.

The first to make Niagara notorious for such feats, was the famous Blondin, whose first performance was given June 30, 1859, on a cable one thousand three hundred feet long, stretched midway between the falls and whirlpool rapids. On this he performed all the feats common to tight-rope walkers, such as standing on his head, walking blind-folded and of carrying a man across on his shoulders. Since then these feats have been duplicated so often that they are no longer profitable enterprises.

Possibly no other athletic sport has developed the daring and marvelous feats as those performed by the bicycle expert. They ride with ease on one wheel, jump over obstructions, ride down long flights of stairs, and ride around on the inside of the "loop the loop," which means that they make a complete circle in the air with only the rapidity of the wheel giving them sufficient centrifugal force to prevent their falling.



A novel bicycle race. The motion of the wheel holds it on the inclined plane, something on the principle of the spinning of a top.

The Origin and Prolongation of Life, Health and Strength

For More Than a Hundred Years. The Discovery of What Life Really Is, What Nerves Are, and How They Carry the Impulses

As nothing is more desirable to man than to be able to prolong his health and strength, so nothing has ever attracted the ingenuity of learned men or that has been of such universal interest to mankind.

The available means of modern science have been as intensely applied to this secret as was ever done in the days of the alchemists, and with results that are more startling, since we now understand more truly the enormous difficulty of the task.

Dr. Paul Gibier, who was sent by the government of France to study the yellow fever in Cuba, discovered that there was a process of the procreation of cells going on in one of the stomachs he had under microscopic examination in his laboratory.

According to that, dead matter could continue to reproduce under some conditions which he could not fathom.



Professor Jacques Loeb of the University of Chicago, the discoverer of the means of creating life. The results of his experiments have startled the whole scientific world.

Dr. Houghton asserts that he can produce amoeba-like cells from crystals. Here is his explanation:

"I found in the course of my experience that by balancing a crystal on each side of a dish and immersed in a medium in which

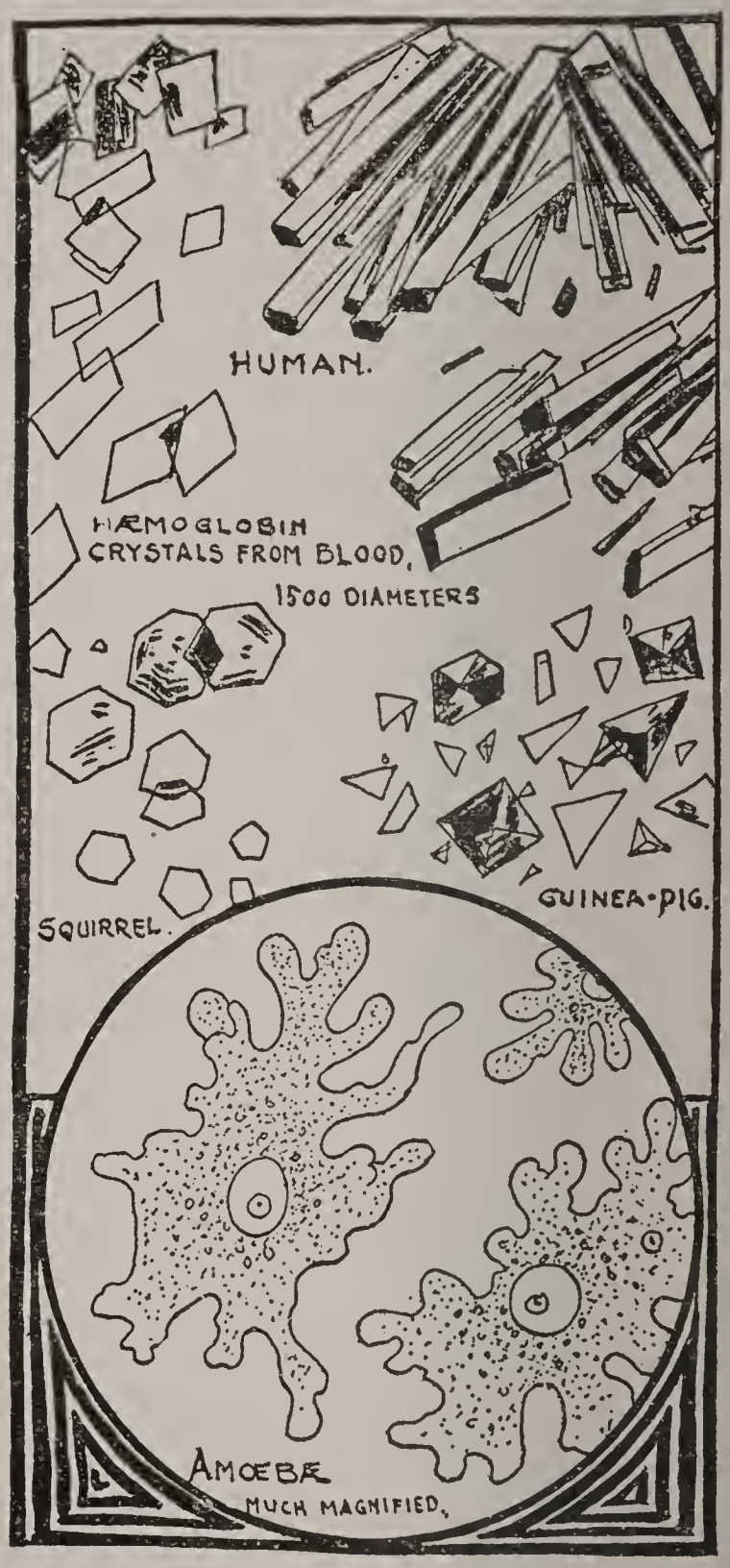
the crystals were chemically operative on each other, but in which they were extremely slow of solution, I could produce a point at which crystallization would not take place at all, but instead a colloid [jellylike] mass would be formed that would exhibit amoeba-like activity. This led me to a consideration of what might be done on a higher plane of chemical activity.

"I succeeded eventually by using an organic substance, in producing an active protoplasmic mass containing distinct nucleuslike centers, which exhibited amoeboid movement. It assimilated nutriment, it gave the reactions to aniline dyes that organic cells do, it had a protoplasmic reticulum [network], it showed selective affinity, and it even made feeble attempts at perpetuation of its species. It split into four or five cells, which exhibited the same qualities as the mother cell. After a period of activity varying in different experiments from half an hour to three weeks, the cells lost their powers and became inert masses.

"My cells fulfill all the conditions of living cells, such as amoebas, except as to the power of perpetuating their kind indefinitely. I think we shall soon discover the necessary element to make a complete and perfect living organism. The first evidence of the formation of his cell, as detected under the microscope, is a collection of specks, which are minute even under the powerful lens. The next stage in the evolution is a group of stresses or stains like those seen in the mixture of fluids that are repellant to each other, the lines radiating from centers. The cell then takes on the protoplasmic or jellylike form. During subsequent changes one or more nuclei or kernels make their appearance in the cell. The cell soon begins to flow hither and thither, like an amoeba, and to assimilate substance from the solution. The mother cell splits up into several daughter cells, all continue their amoeboid activity for their brief spell, and then they die, unable to produce a third generation.

The Origin of Life.

"There are several theories as to the origin of life. The evolution and mechani-



In the upper part of the picture is shown hæmoglobin crystals from human blood magnified 1,500 diameters. Near the center are shown the crystals from the blood of a squirrel and a guinea pig. At the bottom are shown the amœbæ much magnified. These are the protoplasmic bodies of the blood, having the power to push out their finger-like appendages and take food into their bodies. The nucleus is shown near the center of each amœbæ.

cal theories start with the assumption of a creation. I am inclined to the geological

theory, which boldly declares life was developed de novo. It is the only theory which does not hold that every cell is descended from an ancestral cell. Science teaches us that the earth once was azoic, without life. At one time it was only a gas, but in the course of the ages the lower forms of life made their appearance. Whence did they come?

"Investigation shows that crystallization has some mysterious relation to life. We know that haemoglobin crystals of various forms can be produced from the blood of many animals. Haemoglobin is the coloring matter of the blood and is a colloid or jellylike substance. Here is a substance in solution that we know possesses crystalline forces. We find crystals everywhere present in decomposing matter. May it not be possible to reverse the process and from crystals produce life?"

Prof. Loeb's Startling Discovery.

Electricity, which has defied all attempts to understand its nature, is at last practically proved scientifically not only to be the seeming basis of all energy, but to be the vital principle in life.

It has long been the theory that the assimilation of food in the body gave off energy in the form of heat, but it now appears that the digestive apparatus is merely a kind of dynamo charging the cells with electricity from the decomposition of the food.

Prof. Loeb says that action of the heart and involuntary muscles are not governed by the chemical production of heat, but to chemical energy in electrically charged molecules. His theory is thus scientifically explained by the following assertions resulting from his experiments:

1. Motor nerves contain or consist of a colloidal solution, of which the colloidal particles carry positive electrical charges.

2. Nerve (protoplasm) is stimulated by the passage of the colloidal particles from a condition of a solution to that of gelation.

3. This change is brought about by the action of ions—i. e., electrically charged atoms or groups of atoms, which bear negative charges. The stimulating action of any chemical compound depends on these negative charges. The stimulating action charges are less efficient than those with two or three.

4. The colloidal particles of the nerve are held in solution by positively charged ions, sodium, potassium, calcium, etc., and the effectiveness of these ions in preventing stimulation varies directly with the number of positive charges they bear.

5. By these facts chemical stimulation is shown to be identical with electrical. Whenever in any part of a nerve negative charges are in excess the nerve is stimulated—i. e., the colloids pass from a solution to a jelly. The stimulus always arises at the kathode or negative electrode.

6. The irritability of a nerve is diminished whenever the solution of the colloids is rendered more permanent. It increases as the nerve approaches the gelatine state. All positively charged ions thus diminish irritability; negative increases it. This explains electrotonus—i. e., the irritability of the nerve is reduced near the anode and increased at the kathode.

7. Heat diminishes the irritability of the nerve by rendering the solution more stable. Cold increases it by rendering it less stable. At high temperature gelation (coagulation) takes place and the nerve is stimulated.

8. The nerve is stimulated mechanically because the colloidal particles are forced together. As they coalesce their surface becomes less, less positive charges can reside on it, and part of the negative charges previously induced in the surrounding water are temporarily set free in their neighborhood.

9. The negative charges thus set free precipitate the next layer of colloids, which, in their turn, set free negative charges. This precipitates the next layer, and in this way the nerve impulse is carried. Technically these negative charges are called the negative variation, and this stimulates each successive element of the nerve.

10. Anesthetics all dissolve fat. They reduce the irritability of the nerve or protoplasm, because the colloids in the nerve (protoplasm) are largely fat compounds and more soluble in a mixture of ether and water than in water alone. All anesthetics render the colloidal solution more permanent and prevent gelation.

11. Besides the number of electrical charges on the ions there is some other factor which determines the action of the salts. Thus potassium is more effective in reducing irritability than sodium; fluorine is far more effective as a stimulant than chlorine, although all carry but a single charge. It is believed that this difference in efficiency of these monovalent anions or kations is dependent upon the rate of rotation of the electron, or the positive or negative point charge, about the atoms with which it is associated. The



A surgical operation before medical students, showing the chief surgeon seated, his assistant standing, the trained nurse nearest the center administering the anaesthetic, the patient covered with cloths, and the clothing worn to prevent infection.

electron rotates about the fluorine atom about twice as fast as about the chlorine atom.

12. The stimulating action of any anion or the poisonous action of any kation is hence a function, first, of the number of charges revolving about the atom; second, of the rate of rotation of these charges; resemble in their action that of positively charged ions.

He further says:

From the results of my investigations along the line I am certain that death is not merely a negative process, but that it is an active process which, if not checked, will lead to disintegration.



Patient ready for the operation in one of our large hospitals. The patient is under an anaesthetic, with the surgeon ready to perform the operation that but a few years ago would not have been attempted. Notice the sterilized garments they wear.

and, third, of the circumference of their orbits.

13. Chemical stimulation is, thus, by the electro-magnetic theory of light, shown to be identical with stimulation by light waves. The stimulating action of any anion increases as the spectrum of that anion approaches the ultra violet.

14. The long light waves and heat waves

These death processes are due, I believe, to enzymatic action. The unfertilized egg of the sea-urchin dies very soon. The fertilized eggs live for years.

It seems that from the time the mature egg leaves the ovary, destructive processes go on simultaneously with the processes of life, which, if not checked, will result in the destruction of the animal within a

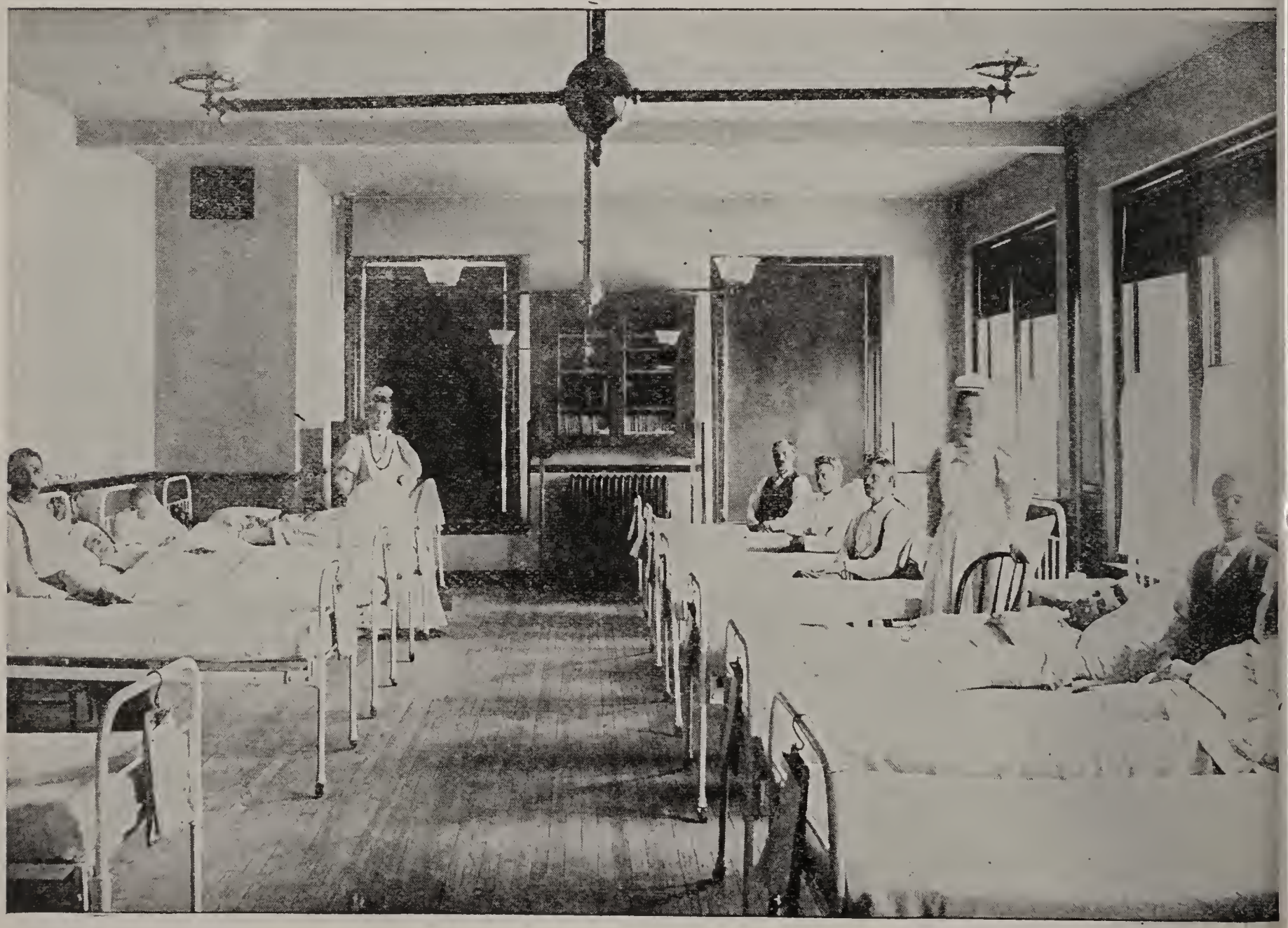
period of about twenty-four hours or less.

Now, by adding potassium cyanide to the sea water, I found that these mortiferous processes could be checked and the life of the unfertilized egg preserved. This, I think, has an important bearing on the problem of the prolongation of life. It appears that everything is in a constant process of growth, dissolution or combination. Life is the ability to resist destructive tendencies or assaults. According to the great biologists the whole secret of the prolongation of life consists in the harmonious assimilation of needful food having the required electrical energy and the purification of the body from its waste particles. Prof. Rudolph Virchow, reputed to be the greatest embryologist in the world, says that the life of an organ is merely the life of its single cells which give it a system. When a sufficient number of the cells die to break the system, the organ must die, and if that organ breaks the physical system the man must die.

Whenever science is able to prevent the dying of single cells or is able to promote the propagation of other cells to keep the system unbroken, the man will not die.

This eminent scientist says: "The day is coming, without doubt, when in the matter of his death man will be the master."

According to the latest scientific theories, every impoverishment or disturbance of electrical harmony between cells hastens death. Thus, the brain being the great reservoir of electrical generation and motion, it should not be subjected to violent action or to exhaustion such as in anger or in prolonged study. With a harmonious mind presiding wisely over a healthy body, there is no reason why every person should not live vigorous to almost any period.



A public ward, showing trained nurses in charge of the convalescent.

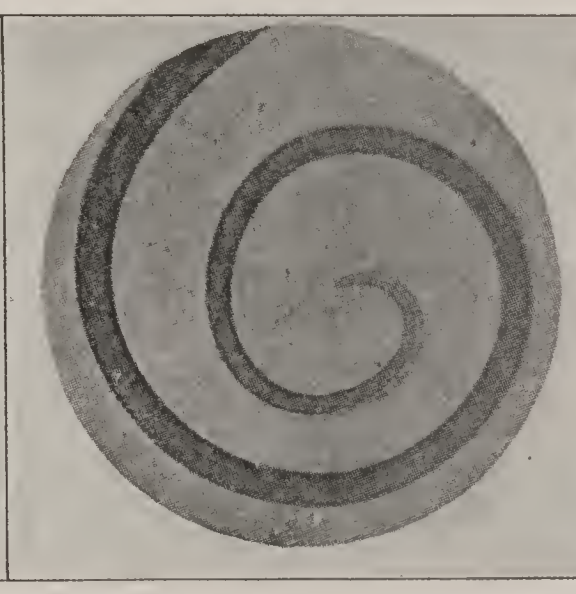
THE ANATOMY OF THE ATOM.

Wonders of the World that human beings can only see through the magnifying lens, showing the microscope has now found its way into almost every profession, and has become one of the most trusty servants of the business man.

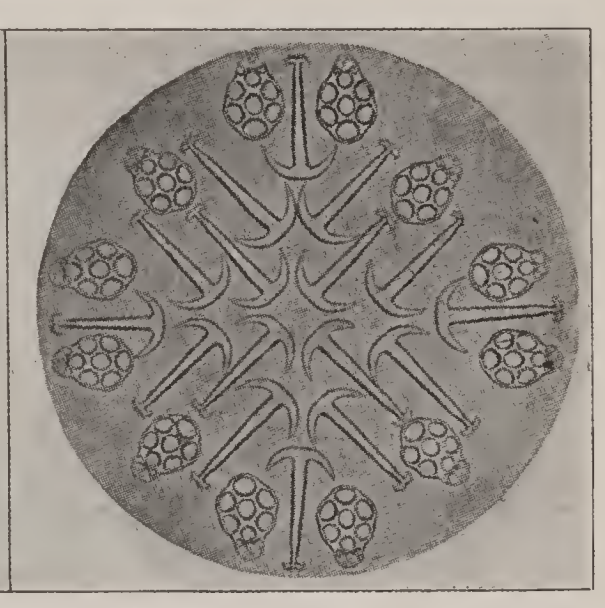
If the ordinary person were asked what creature occupies the middle place as regards size in the animal world, he would most likely answer the horse or cow. The fact is, however, the ordinary house fly would be about the center of the line were



Minute portion of a negro's scalp. In the case of most white people, the hair grows vertically through the scalp, but the negro's hair grows in a curved line from the roots, and is therefore curly.



The tongue of a moth magnified many thousand times. Notice the remarkable length as compared with the diameter.



A living atom, showing the prongs on which lodge the particles of food that supply it with its sustenance;—magnified one million times.

all of the different animals standing in a row in the order of their sizes. Imagine whales and elephants at the beginning of the line, and at the end of the line animals



Cholera germs, with one lash-like appendage (flagella); typhoid with numerous flagellæ. These flagellæ are used as a means of locomotion. Magnified one million times.

as much smaller than the fly as the fly is smaller than the whale or elephant. Think of the space covered by a little fly on the back of an elephant, and then of the proportionate amount of space on the back of a fly covered by a microbe.

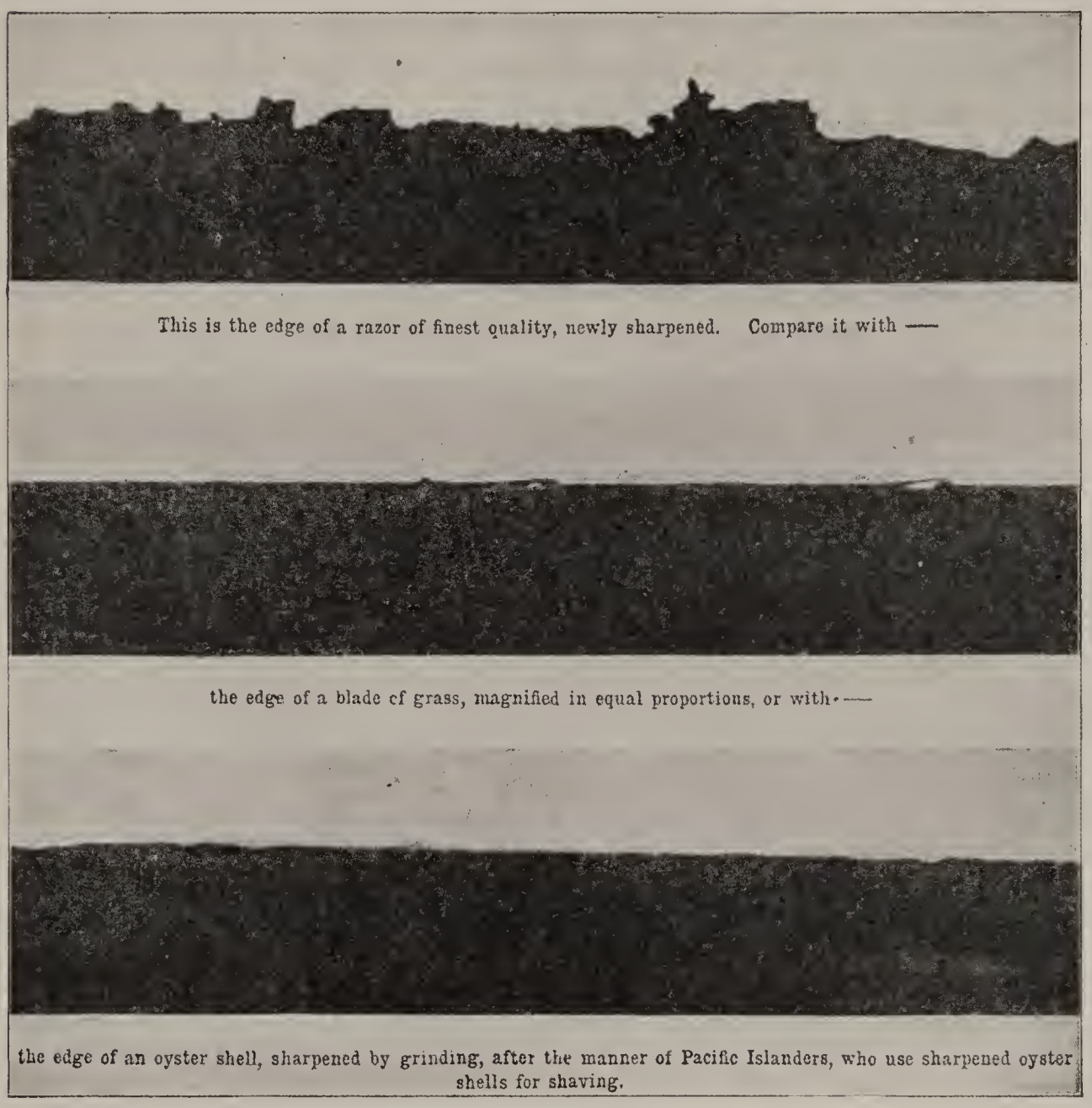
In the days before the flood, the Ichthyosaurius existed with eyes measuring one foot in diameter. These immense light-gathering orbs must have enabled him to view countless myriads of stars, which human beings cannot see even through the strong telescopes. The traveler who roams



The white corpuscles of the blood attacking the invading bacilli. The corpuscle takes the bacillus into its substance and destroys it. Sometimes the bacilli are too vigorous and numerous for the corpuscles, and destroy them. This fight between the bacteria and the blood cells is going on within us every moment of our lives. Magnified one million times.

the earth over, trusting to his own eyes, sees but little of what really exists around him.

A drop of water furnishes enough life



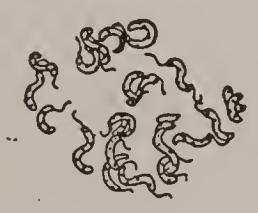
This is the edge of a razor of finest quality, newly sharpened. Compare it with —

the edge of a blade of grass, magnified in equal proportions, or with —

the edge of an oyster shell, sharpened by grinding, after the manner of Pacific Islanders, who use sharpened oyster shells for shaving.

to occupy one for a month in interesting study.

There are more than 300 species of small flies, of which the house fly is but one. It might reasonably be supposed that little flies grow into big flies, but actually a fly never grows. It is hatched from its pupa, full grown and developed. The number of living things, plants and animals that are generally familiar is insignificant compared with the countless myriads of diminutive living particles which infest



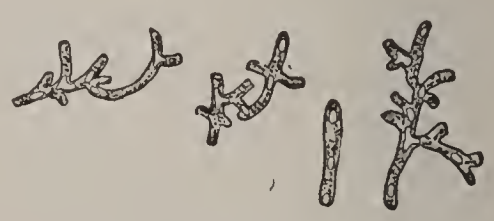
One of the forms of germs causing blood-poisoning. Magnified two million times.

all our surroundings, swarming in the air we breathe, the food we devour, and on every inch of ground on which we stand.

With the microscope the shape of these minute forms becomes as well defined as any domestic animal's A common length for microbe organisms is one twenty-thousandth of an inch. Four hundred million of these organisms (and they are by no means the smallest known) could be spread in a single layer over a square inch.

Under the microscope the quality and texture of cotton, woolens and silks is easily seen. The fibers in a pattern can be counted, and the fibers of one kind of woolen unmistakably told from fibers of any other kind.

Every kind of hair in the same way is absolutely distinct from other kinds. Some years ago a small portion of dried skin was submitted to a microscopist, who found some fine hairs on the surface, and pronounced them to be human hairs. This



Tubercle bacilli. Magnified three million times.

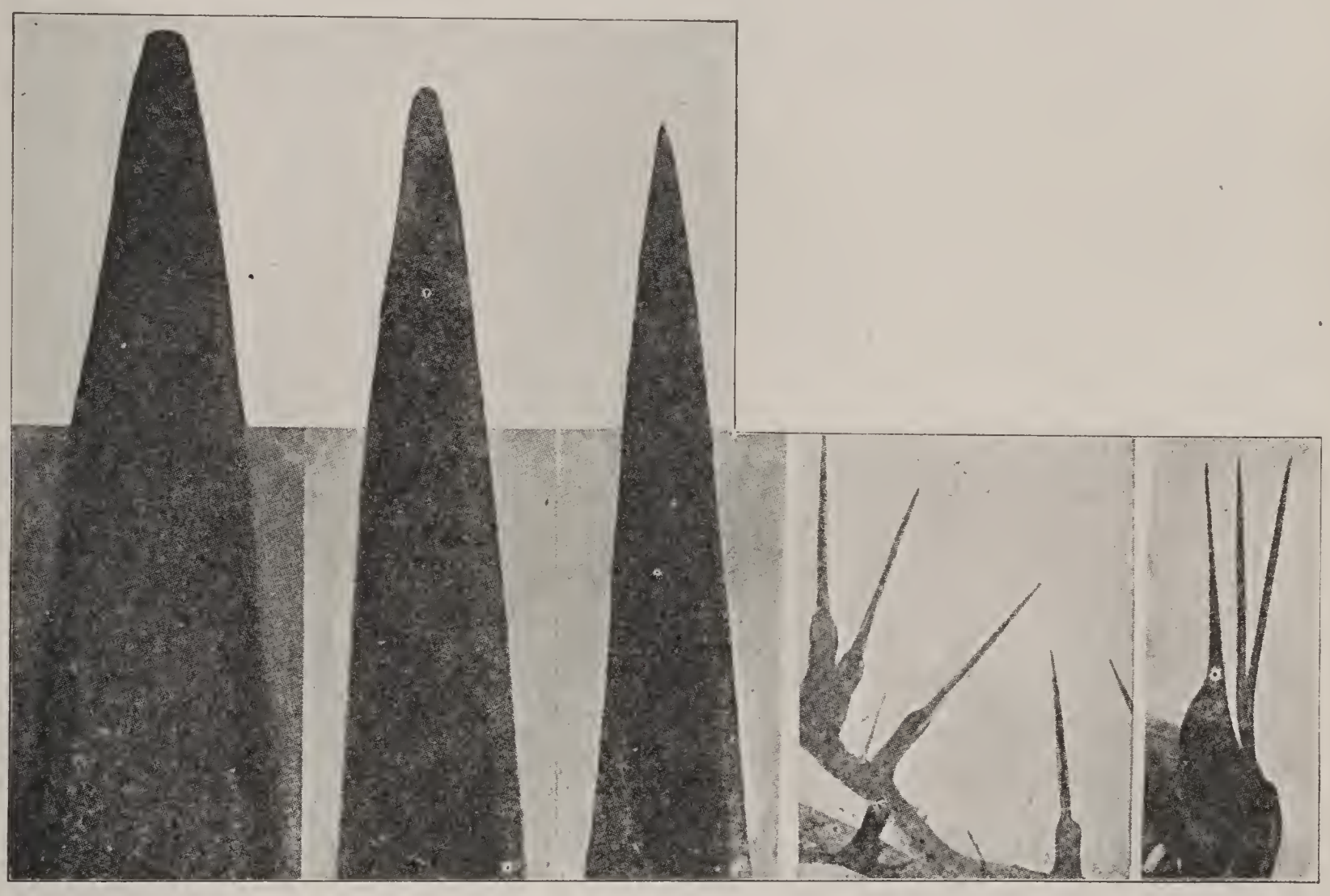
was interesting, for it happened that the piece of skin had been taken from an old church door on which a thousand years before the flayed skin of a Danish robber had been nailed as a warning to violators of churches.

Every person carries about on or in his body scores of varieties of microbes without the least inconvenience, until some accidental lowering of his vitality gives them the opportunity for attack. Many forms of microbes in their natural state on dead organic matter are nothing more than a mould, but when in living beings, become active germs.

The process of souring of milk is caused by a form of bacteria using up certain elements of the milk and out of them making lactic acid. The tubercle bacilli or the germ of consumption produces disease only when predisposition exists. Such may be inherited or self-imposed. The strong, well kept constitution is impervious to their attack.

Germs adapt themselves to their surroundings. The round form of the germ that lives on dead matter may become rod-like when living as a parasite in man. Hunger, irregular and poorly cooked meals, excessive fatigue, mental anxiety, the depression of defeat, homesickness, etc., all modify those orderly conditions in the tissues upon which health depends. Under such conditions man succumbs to disease-germs, which to normal health would be harmless.

The microbe undoubtedly was in existence long before man appeared upon the earth, and doubtless will wander in search of pastures new long after man has ceased to be. Compared to the microbe, man is the creature of the hour, for it may be truly said that the microbe is older than the everlasting hills, and that long after these shall have been leveled to the plain the microbe will continue to fulfill the destiny and purpose of its being.



POINT OF A NEEDLE. THORN OF A GOOSEBERRY. THORN OF A ROSE. POINTS OF A STINGING NETTLE. STINGS OF A BEE.

All are magnified an equal number of diameters. This shows how infinitely finer is Nature's workmanship than the finest work of man.



BIRTH OF THE LANTERN FLY

Why Is It So Easy For Birds to Fly and So Difficult For Man?

WHAT IS THERE ABOUT THESE WINGED BEINGS THAT ENABLES THEM TO SAIL THROUGH THE AIR FOR HOURS WITHOUT ANY APPARENT EFFORT ON THEIR PART? EACH FEATHER A PERFECTLY EQUIPPED FLYING MACHINE.

For many generations, it has been confidently predicted by learned men that the next generation would find men navigating the air with the ease of birds, and yet, with all the inventive genius of modern times, man has made but a feeble imitation of the ability of birds. They are past masters in the art, while we as yet have scarcely begun to learn anything about it. Birds inhabit the atmosphere in untold multitudes. Such species as the condor and frigate bird may be said to live in the air. The frigate will not touch a rigid support often for a month at a time, stealing his food from fish hawks and floating in great circles to the height of a mile or more while it is being digested. The condor carries its twenty pounds with an additional ten pounds of freshly gorged carrion to an altitude of three miles, and



A balloon factory. Those here shown are for the Baldwin-Ziegler Expedition

serenely waits for an empty stomach to return to earth.

If a thirty pound condor can circle around for six days, three miles high in the air why cannot a man? Is there something wrong? Science is as dumb as the Sphinx when confronted by a soaring bird, and common sense is baffled. The bird carries no engine with it. It does not move the flappers it has after it gets well going. Its moving parts seem to be of use only to get it off some unknown dead center. Once going it is a genius of the lamp, violating all known mechanical laws, persistently doing work in holding up a heavy body and overcoming atmospheric resistance at the rate of fifty feet per second without discoverable expenditure of energy.



The Falcon. The strongest of birds. They have been known to fly one hundred and fifty miles an hour, and over five hundred miles without resting.

A condor will alight on a carcass after being six days in the air and go to work

as if it had enjoyed a long rest. To say that there is always wind where the birds are is no help. Why cannot a man float in wind as well as a bird? Any wind, or no wind at all, is all one to the bird. Does the weight of the man act differently from that of a bird, that he comes down so promptly?

What is a feather? It is an air engine and the bird surfaces are made of them. They have been looked upon as a light, flexible material for making an extended surface impervious to air, that would readily fold upon itself, and their exquisite mechanical structure has been overlooked. They consist of a quill and two vanes, made up of spicules, between which are the plates. The plates cross a channel, about one-fortieth of an inch wide, made by the spicules. These channels are open through the thickness of the feather. The plates are hinged to the spicules at one end only, the other terminating in hair-like serrated appendages which look into each other, lapping over themselves in the center of the channel. There are about 1,000 of them to the inch, or practically innumerable, and they are located at the outer surface, filling about the one-fifth part of the depth of the channel. They are about one twenty-thousandth inch thick, as nearly as an amateur with the microscope could determine, so that nineteen-twentieths of the space is open to the passage of air. Thin as they are, they are ponderous when examined edgewise with good specimens of the gold-beater's art. They are capable of rotating through about 25 deg., and are beautifully curved at their outer edges.



Ice yachting on the Hudson. These yachts sometimes travel at a rate greater than a mile a minute, and race with the fast express trains. While in ice yachting one isn't supported by the wind, one is propelled by it over a surface of little resistance, and the sensation is that of flying.

The curved edges of the plates are to the

rear in the extended wing. The mechanical service of the plates is obvious. The curve impinges against the air current through the feathers and drives the bird to the front. Pressure produced by the normal factor of weight is thus made to serve as the motive power of flight.

The lover of nature who is familiar with wilds unfrequented by men may witness activities seldom seen in populous places, and the struggle for life between a Wilson's hawk and yellow hammer on the Colorado Mountains indicates the possession of some mechanical energy greater than can be produced by pressure action. A frigate bird of our Southern coasts can move vertically upward for half a mile, at a velocity of 100 feet per second, with no visible wing motion whatever. There is a spiral configuration of the plates where they meet in the center of the channel, which, possibly combined with the pressure action, may augment the forward thrust by introducing some molecular energy into the case. These very curious and novel exhibitions of motion still require explanation, and it may be found that the ordinary equilibrium pressure of the atmosphere of fifteen pounds to the square inch may be upset by this fine plate work mechanism.

The motor cycle is the only means by which man can approach the wonderful speed attained by birds, except the railway trains which can only be run on expensive and elaborately constructed tracks. Motor cycles can travel over nearly any kind of road and climb steeper hills than the horse. The steam and gasoline vehicles give promise of revolutionizing short distance transportation.



Race at better than a mile a minute between two motor cycles. Notice a "look-out-ahead" in each vehicle, kneeling to make as little atmospheric resistance as possible.

The Coronation of England's King and Queen

The Ceremony that has prevailed since the Medieval days. Each function with a symbolical meaning. Much of the ceremony founded upon teachings of the Old Testament.

The last coronation of sovereigns in Westminster Abbey, previous to that of King Edward VII and Queen Alexandra, was that of King William IV and Queen Adelaide. The spectacle is intended to be as gorgeous and impressive as it can be made.

In the center of the Abbey, facing the altar, is placed the coronation chairs. That for the king is the chair of Edward the Confessor, with the stone of Scone beneath the seat; that for the queen the chair in which Queen Elizabeth was crowned. The stone of Scone is that upon which the Kings of Scotland were crowned. The legend associated with it is that it is the identical stone upon which Jacob laid his head when he dreamed of the angels ascending to and descending from heaven. It was Edward I who brought it from Scotland, and it has ever since been used at coronation services.



King Edward on the Throne.

It is necessary to mention these details in order to emphasize that, while pomp and ceremony form essential features of the coronation, each act in the solemn proceeding has its symbolical meaning. It has been aptly described as "a set of great living pictures, illustrating the relation of the king and queen to the constitution, and to one another." The coronation is a great ritual of state. Every single detail associated with it has its meaning, and in having its meaning, has its use.

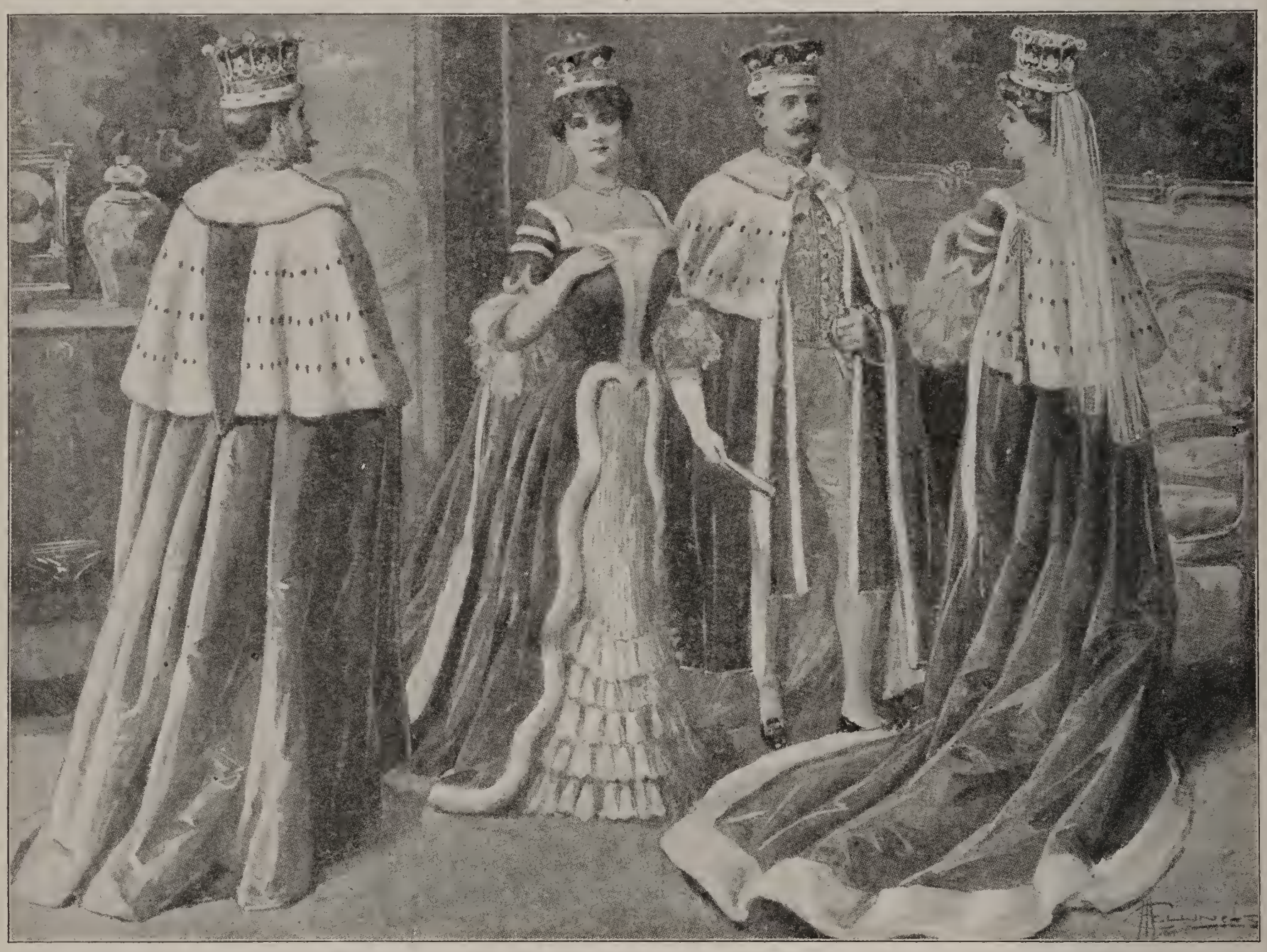
In the early hours of the morning the regalia is brought from the Tower, and while their majesties are passing through the serried ranks of citizens on their way to the Abbey the peers, bishops and other representatives who have been assigned parts in the royal procession meet in the Jerusalem chamber. From the lord great chamberlain they receive their respective charges. This official, it may be incidentally mentioned, is one of the greatest lay officers on this particular day. In former times it was his duty to dress the king on the morning of the coronation, to provide the coif and linen gloves, to bring the oblations, to strip the king for his anointing, to put the spurs and the sword on the king and to provide the crown and robes used after the service. In the procession he goes by himself, with his white wand of office in his hand. His fee, which is now compounded, was also enormous. It used to be forty yards of crimson velvet, the king's bed, bedding, apparel and all the furniture of the room in which his

majesty slept the night before the coronation.

The king's regalia comprises St. Edward's staff, the spurs, the scepter with the cross, the pointed sword of temporal justice, the pointed sword of spiritual justice, curtana, or sword of mercy; the sword of state. the scepter with the dove, the orb, St. Edward's crown, the patma, the chalice, the Bible.

Officers of arms.
The prebendaries and dean of Westminster.
His majesty's household, with pages carrying their coronets.
Princes of the royal blood, their coronets borne by viscounts.
The queen's regalia.
The queen in her royal robes, her train borne by the mistress of the robes, assisted by six daughters of earls. Walking on either side will be a bishop.

Next in order will be the maids of honor and other ladies of the queen's household



Earl. Baroness. Baron. Countess.

The costumes worn by Peers and Peeresses at the Coronation of the King of England. The capes are of snowy white ermine.

The queen's regalia consists of the ivory rod with a dove, the scepter with the cross, her majesty's crown. Each plays its part in the subsequent ceremonial; to each a special significance is attached.

The arrival of the king and queen at the Abbey is the signal for the formation of the procession in the following order:

Then comes the king's regalia borne on velvet cushions. Preceding his majesty is the Prince of Wales, his little son, Prince Edward, who will, in the fullness of time, succeed to the throne; the aged Duke of Cambridge, and other princes of the royal house, all with their trains borne by noble lords.

The king follows, wearing his royal crimson robe of state, six eldest sons of dukes acting as trainbearers. By his side walk two bishops, while the rear of the procession comprises members of the king's household and the ancient yeomen of the guard in their quaint and picturesque garb.

Crowning the King.

The coronation service falls into three divisions. The first is mainly introductory. It consists of the election of the king by the people and the oath taken by the king to govern to the best of his power. When these purely formal preliminaries have been determined the main part of the service begins. The second division contains the important rite of unction round which the whole service revolves. It consists of prayers blessing the king before unction and the unction itself. Then follows the third division of the service, which is the natural consequence of the second. It comprises the delivery of the royal ornaments and the enthronization.



King Edward VII.

From a literary point of view it cannot be said that the coronation service attains great excellence. The prayers are long, rambling compositions, filled with a wealth of Old Testament illustration that might have been used by one of Scott's Covenanters, interspersed with truculent allusions to heretics. And the dread of violence and injustice on the part of the king is very evident. It seems as if the writer of the prayers was not satisfied that the oath was efficacious in preventing these misfortunes, and that he was determined, by means of the prayers to preach to the king the excellence of peace and justice, while at the same time invoking the aid of

heaven to keep the king to these virtues.

As the imposing procession makes its way to the chancel, watched by representatives of every part of the empire and of the world, the choir will sing "I Was Glad When They Said Unto Me," a psalm that has been for some reason unknown, sung at every coronation ever since the sovereigns of England came to the Abbey to be crowned. On reaching the platform or theater the queen will remain standing by her chair of state, set below the throne, until the arrival of the king. When all the members of the procession have taken their places then will come the act of recognition. The aged archbishop of Canterbury, accompanied by the high officers of state, will go to each side of the theater and will address the assemblage in the following terms:



Queen Alexandra of Great Britain.

"Sirs, I here present unto you King Edward VII, the undoubted king of this realm; wherefore all of you who are come this day to do your homage, are you willing to do the same?"

At the same time the king, in accordance with custom, will turn to those whom the archbishop addresses, so that he may be well seen, and the brilliant assemblage will shout, as with one voice, their joyous assent. It was this shout that caused the catastrophe that occurred at the coronation of William the Conqueror. The Norman soldiery mistook the shout of acclamation for shouts of revolt and burned the houses in the neighborhood.

Obligations and the Oath.

After the king has made his first oblation at the altar the queen, supported by the two bishops and preceded by her regalia, will do likewise. Then will follow

the litany, the communion service and the sermon.

Again the king becomes the central figure in the great historic drama. It is at this stage that he takes the oath to govern the people according to their national laws and customs. Of the whole of the long service nothing can approach in significance the anointing. Without it the king cannot receive the royal ornaments; without it, in a word, he is not king.

While this portion of the service is performing four Knights of the Garter will hold a canopy of cloth of gold over his majesty. The archbishop will anoint the king in the form of a cross, first on the palms of the hands, secondly on the breast, thirdly on the shoulders and back, fourthly on the inside of the elbows, and lastly on the head.

Before the archbishop places the crown on the king's head there will come the investment of his majesty with the supertunica of cloth of gold, the touching of his heels with the spurs, the handing to him of the sword of state and the orb, the placing of the ring on the fourth finger of the right hand, the receiving of the scepter and the rod with the dove.

As the sovereign is crowned all the peers will put on their coronets, the kings of arms their crowns and the archbishops their caps. At the same time will arise shouts of "God save the king," and from park and tower guns will be fired, signifying to the vast throngs on the streets that the king has been crowned.



Queen Victoria taking the Religious Oath, Westminster Abbey, June 28th, 1838.

When the last of the barons has rendered his fealty to the king, then comes the crowning of the queen. Her majesty, supported by the two bishops and attended by her train bearers and others, approaches and kneels before the altar. A prayer is

offered, the queen moves to the faldstool placed for her between King Edward's chair and the steps of the altar, and her ladies remove her coronet. Then, as she kneels before him, the archbishop anoints her with the holy oil, pouring it in the shape of a cross on her head and blessing her in the name of the Trinity.

After the anointing the archbishop puts the ring of sixteen rubies on the fourth finger of Queen Alexandra's right hand, bidding her "receive this ring, the seal of a sincere faith," as a guard against the infection of heresy. Then, as the ladies hold a golden pall above her, comes the act of crowning. At the same time all the peeresses in the Abbey put on the coronets, which, until then, have been carried. Into the queen's hands is placed the scepter and rod of ivory, and with these symbols of sovereignty her majesty returns to the theater, and, bowing reverently before the king, mounts the throne placed for her on his left hand. And as they sit side by side there rises the sound of music as the great choir sings an anthem of thanksgiving.



The Coronation of the Queen.

The Louisiana Purchase

And Its Centennial Commemoration by the World's Exposition at St. Louis. The General Plan, Officers, Etc.



Director of Exhibits. Director of Works.

Napoleon hated England and embodied the feeling of his entire race. In the beginning of the 19th century England became victorious on land and sea. France was humiliated and at that time almost without funds. Then the master genius of Napoleon blazed forth. He saw that the interests of the United States and France were one in both hatred and fear of Great Britain. Although it was kept for many months a profound state secret, yet it was shrewdly guessed that France had acquired from Spain the vast territory lying west of the Mississippi known as Louisiana. If France and England went to war the first thing the English would do would be to seize this territory, and they could do it, for Gouissan L'Ouverture, the black hero and liberator of St. Domingo, had almost destroyed the French forces in the Indies. This would be a menace to the United States to be thus surrounded by England and a great loss to France. Besides, France

needed money in the war that was imminent between the two hereditary enemies.

Dec. 15, 1802, President Jefferson notified Congress that Louisiana had been sold to France and that the Spanish pronunciamento forbidding American citizens the purpose of buying a perpetual right to wharf at New Orleans.

This was the extent of the ambition of the American people for territorial expansion. In the midst of these negotiations, on April 10, 1803, Napoleon announced to



Main entrance and sectional view of Liberal Arts Building, Louisiana Purchase Exposition, St. Louis, Mo.

use of the wharfs at New Orleans was in full force.

This information caused great excitement, especially in the Western States, as it shut them off from the great outlet to

his councillors that he had determined to offer the entire region of Louisiana to the Americans. Never was proposition so rapidly consummated. Within three weeks the enormous and momentous transfer was



Machinery Building of the Louisiana Purchase Exposition. Owing to the great number of inventions and recent improvements in machinery, this structure will contain the most interesting and valuable exhibit of machinery ever made.

the sea. James Monroe, afterwards president, was sent as Minister Plenipotentiary and Envoy Extraordinary to Paris to act in concert with Minister Livingstone at Paris and Minister Pinckney in Spain for the

made. The people were amazed suddenly to find themselves not in possession of a mere wharf at New Orleans, but of a mighty expanse of unknown territory. For this $16,000,000 was paid, that is,

ess than two cents for each hundred acres.

It was all done so secretly that the Minister of England at Paris knew nothing of it, until the thing was done. He at once demanded his passports and left the country. The French ambassador at London did the same. They were personal friends and they crossed each other's path at Calais, where they bade each other a tearful farewell, knowing that in a long bloody war one or the other of the nations would go into ruins with the victory of the other, making it supreme among nations.

The struggle came on and Wellington, the Iron Duke, became the conqueror of the Military Hero of the World.

President Jefferson lost no time in taking possession. Boats loaded with American soldiers and flying the American flag moved down the Mississippi and hoisted the stars and stripes over the Spanish forts.

A number of English gunboats in the mouth of the Mississippi were there awaiting the signal to take the territory from the French, but they suddenly put to sea when they saw the approach of the American flag.



The Temple of Fraternity, one of the most artistic Buildings of the Exposition. Here will meet the various societies, orders, and lodge fraternities of the world.

On Jan. 8, 1815, General Packenham tried to seize the lost opportunity, but he was defeated by General Jackson.

In commemoration of these marvelous events is the World's Exposition at St. Louis in 1904. Not alone the resources of the vast Louisiana territory is to be shown, but every enterprise, industry, production and progress of modern civilization is to be exhibited.

Systems of Mind Cures

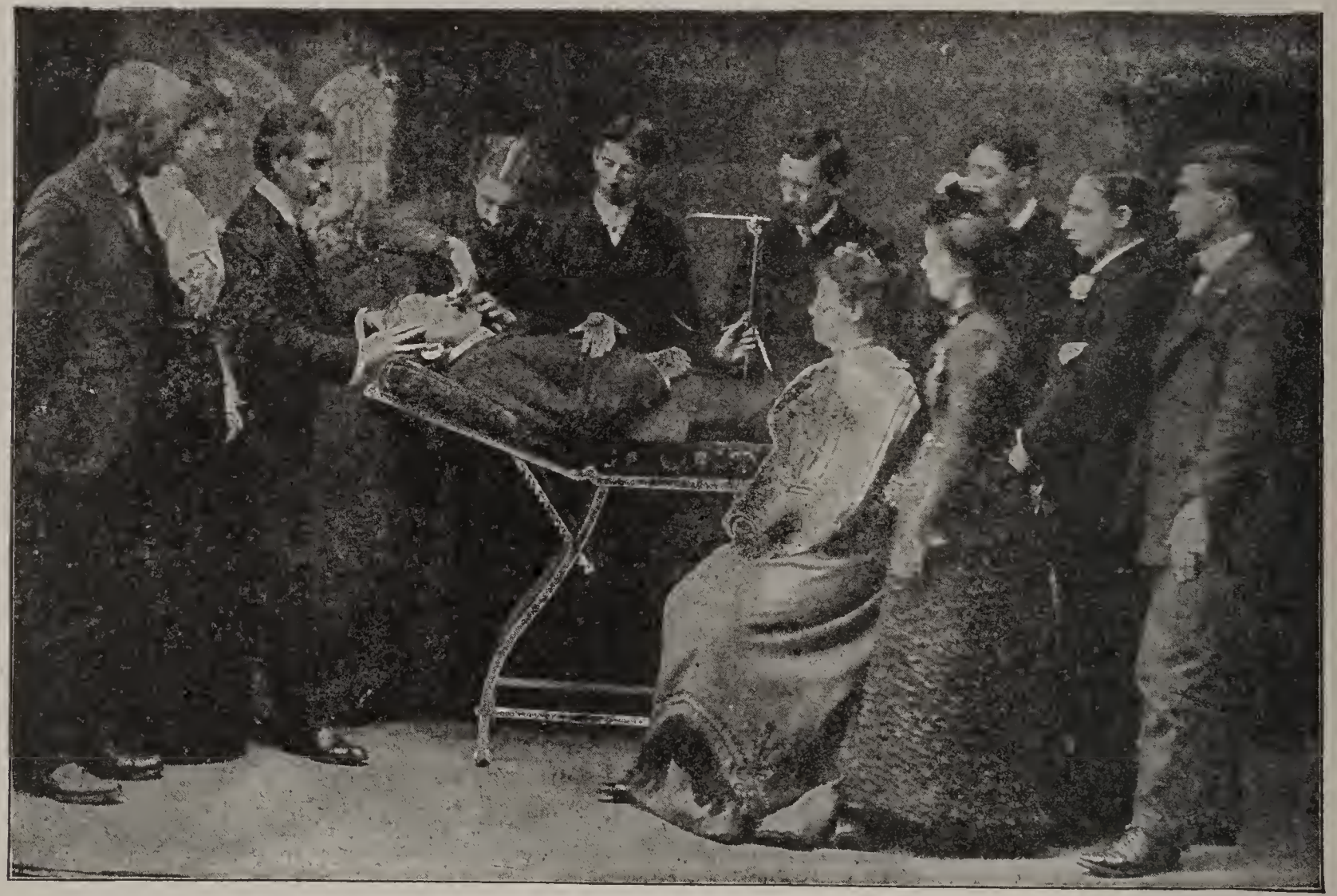
Christian Science; Healing by Faith; Continued Thought Leads to Conviction, and if in Wrong Channels Dwarfs Intellect and Leads to Harm, as is Demonstrated by the Results of Teachings of Anarchists.

The schools or systems of psychological metaphysical cures are as numerous as those of the physical methods. Each has its distinct formula or materia medica, as it were.

Faith healing brings immediate results or none at all. The main if not the sole means is faith that the operator or that the agency of which he is the medium will effect the cure. The result may be expected from a relic, a shrine or from God.

Faith is not essential in the mind cure, but conviction, which is another form of faith, is essential. The philosophy of the cure is that the mind is a store house of energy and that it can so direct its stimulus to the affected part as to cure it.

Christian science cures by the effects of negation; that is, pain and disease and evil are all fictions or hallucinations of mind, which, if disposed of so that the mind is restored to sanity, the trouble disappears, since matter cannot be diseased, pained or evil.



Dental operation performed under suggested anæsthesia.

In faith healing the cures are not so numerous, for there are few diseases over which the mind can exert immediate effect. These are the nervous forms, such as hysteria, headaches, etc.

Mind cures have more of a basis, for

time is given for the influence to take effect and frequently by that time the crisis of the disease has naturally passed.

Christian science in a measure combines both faith healing and mind cure. It thus has an advantage over all by combining the attendant or influencing physician and the benefits of both nature and faith.

The principles of all these cures are as old as history and have been practiced in past ages at times almost universal. The adherents of these methods of obtaining cures are probably now less in numbers than at any time previous to the nineteenth century, during which time the principles of mental healing were lost either in skepticism, the rise of medical practice, and the enthusiasm of religious fervor.

That the mind has innate power to resist disease, pain and evil, no one who is acquainted with the fact for a moment doubts. Nothing in all human experience is more abundantly and constantly attested than this, but equally certain is it that the mind does not have the power to overcome where the attack destroys faster than there are resources from which to build up.

There is much in the determination of the will but plainly not everything, since the will itself, like every known power, has its limitations. As we live from thought to thought by suggestion, so the one who yields to the worst suggestions of wound or disease will die, while those who are angered at being thus intruded upon or fiercely determine upon regaining the lost health will become well. Like mountain climbers, those who think of the depths below are most likely to get there at the first foot-slip, while those who think only of the top improve every medium of support and upward help.

Therefore in every ill, whether of misfortune, unhappiness or disease, keep the



Inducing the Hindoo sleep. Showing the power of a strong mind over mental and physical force of others.

current of the mind ascending or it will descend with all that it controls.

Anarchy and Socialism.

Terms of reproach become so often mere epithets of interchangeable use, that the real meaning of each is confused. This has long been almost universally true of the terms anarchist and socialist. Both these creeds have been alike execrated, though they are extreme opposites and antagonists.

Anarchism expects to realize the ideal of human welfare through radical individual liberty. Socialism expects to reach the same result through the individual yielding all his social rights to the state.

The anarchist says that there is no such right in existence as that of one person to rule over another by any law. He literally interprets Emerson's idea that every man should be a king and every chair a throne.

The socialist believes that society should be all and over all, every individual being an obedient employee of the community.

Anarchism wants to establish absolute social equality by abolishing all government. Socialism desires the same thing, but through making the government the owner of everything.

The peaceful and benevolent Proudhon is the originator of the system of thought that is the basis of the widely divergent ideas of both anarchy and socialism. He answered the question, "What is property?" by the reply, "It is theft."

The anarchist wants all property to be equally divided among individuals, the socialist wants the government to be the owner of it all in trust for the equal use of its citizens.

Karl Marx and his disciple, Ferdinand Lassalle, perfected the argument advanced by those who believed in a community of interests. They argue that no one is born to the right to more property than others, but that all are born mutually dependent. Therefore, the community is a natural and necessary product which should own all for the benefit of its members.

The links in the argument may thus be formed:

1. The child is born with the right to live.
2. The right to live presupposes the right to the means to live.
3. This right is not complete or just if it is not equal.
4. That equality can never be reached when property or the equal means to live is allowed to be seized or secured by the strongest arm or brain.
5. Therefore, the mercy, justice and rights of the individual should be lodged in the community.

MODERN PROGRESS IN THE MAKING OF ARTISTIC EARTHENWARE

THE SPECIAL DIFFICULTIES AND THE PECULIAR ATTRACTION OF THE POTTER'S ART



Ornamenting pottery by painting the earthenware before burning it. Experience enables the artist to produce very brilliant effects, the burning process changing the pottery and the decorations, and making the effect entirely different in the finished product.

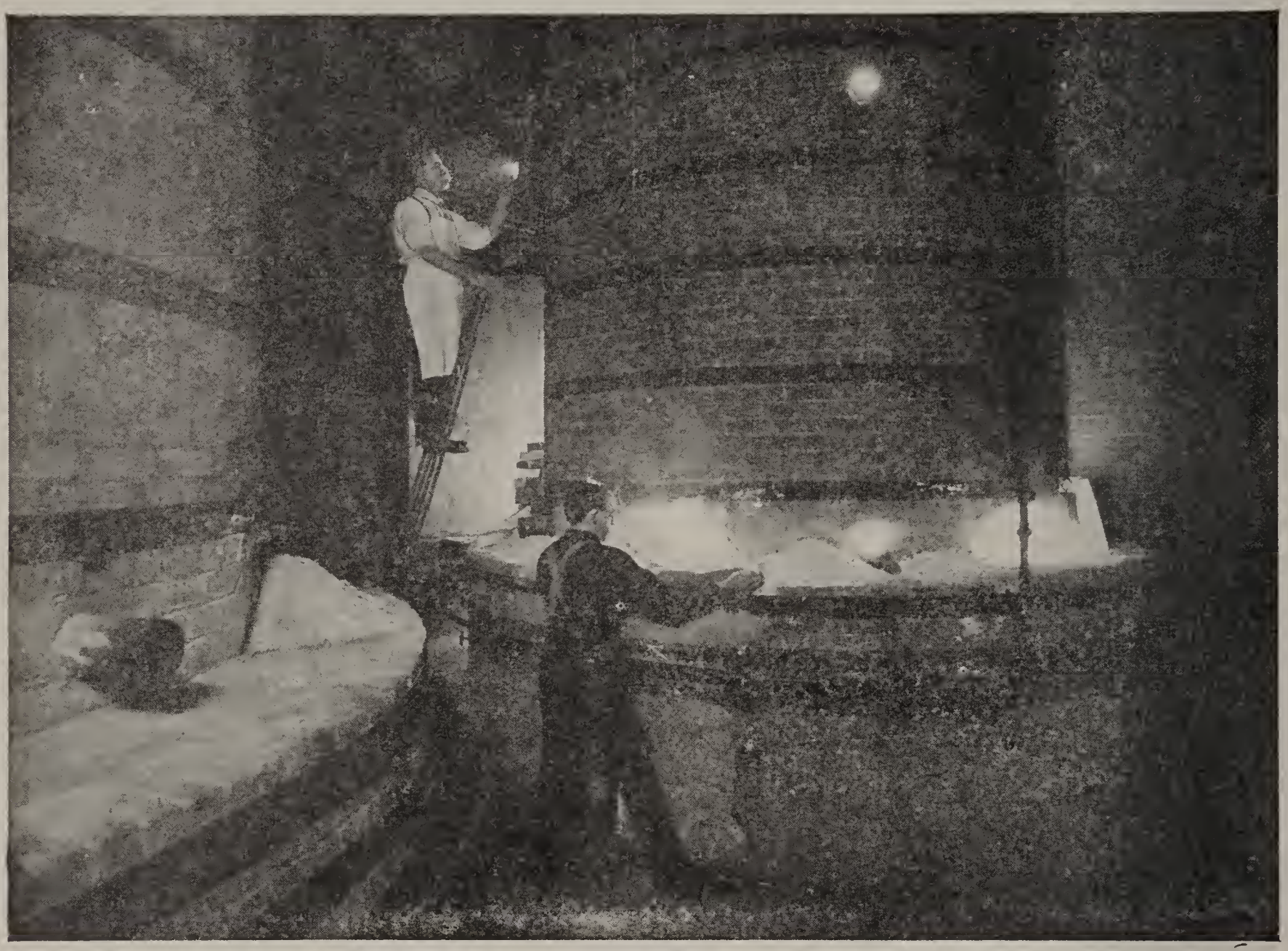
It is difficult for those who have never owned rare and artistic pottery to realize the genuine delight that many persons take in fine ware. For centuries this love of fine pottery has survived, and many pieces of artistic design and coloring exist to-day, bearing silent testimony to great skill and appreciation of artistic effects by the old Egyptians, Romans and Assyrians.

Clay has a tendency to contract in the baking from an eighth to a tenth. This is why terra cotta is not used more for building purposes, as large pieces shrink unevenly. To reduce this shrinkage, sandy clay is often added. A flint mixture helps the glaze. Ball clay enables the mass to

stand the high temperature, and feldspar adds to the sonorous ringing quality of the ware.

Some pottery that is full of pores can be produced at low temperature, such as flower pots and the water jars used in tropical countries as coolers, the spongy texture allowing water to transpire slowly so as to produce constant evaporation on the exterior surface, thereby causing a lowering of the temperature within the ware.

A great deal of pottery is made in Mexico. Some is made in Pennsylvania, Louisiana and many other states. An ancient seat of the potter's art is the Black Forest in southwestern Germany. France produces much very fine ware, and Italy has many famous pottery kilns. In fact, nearly every country and every section of every country produces pottery, each with a certain distinctiveness.



A pottery kiln. During the burning process the temperature of the kiln has to be carefully watched in order to subject the pottery to the proper degree of heat. Much skill is required in the burning of the higher grade of earthenware.

Gold presents a grave difficulty in pottery and porcelain. Gilding can stand only a certain amount of heat, so it must be applied last, and fired carefully, because if the heat is too great, it turns dark. Lead, potash and borax are prominent ingredients used as the glaze on pottery.

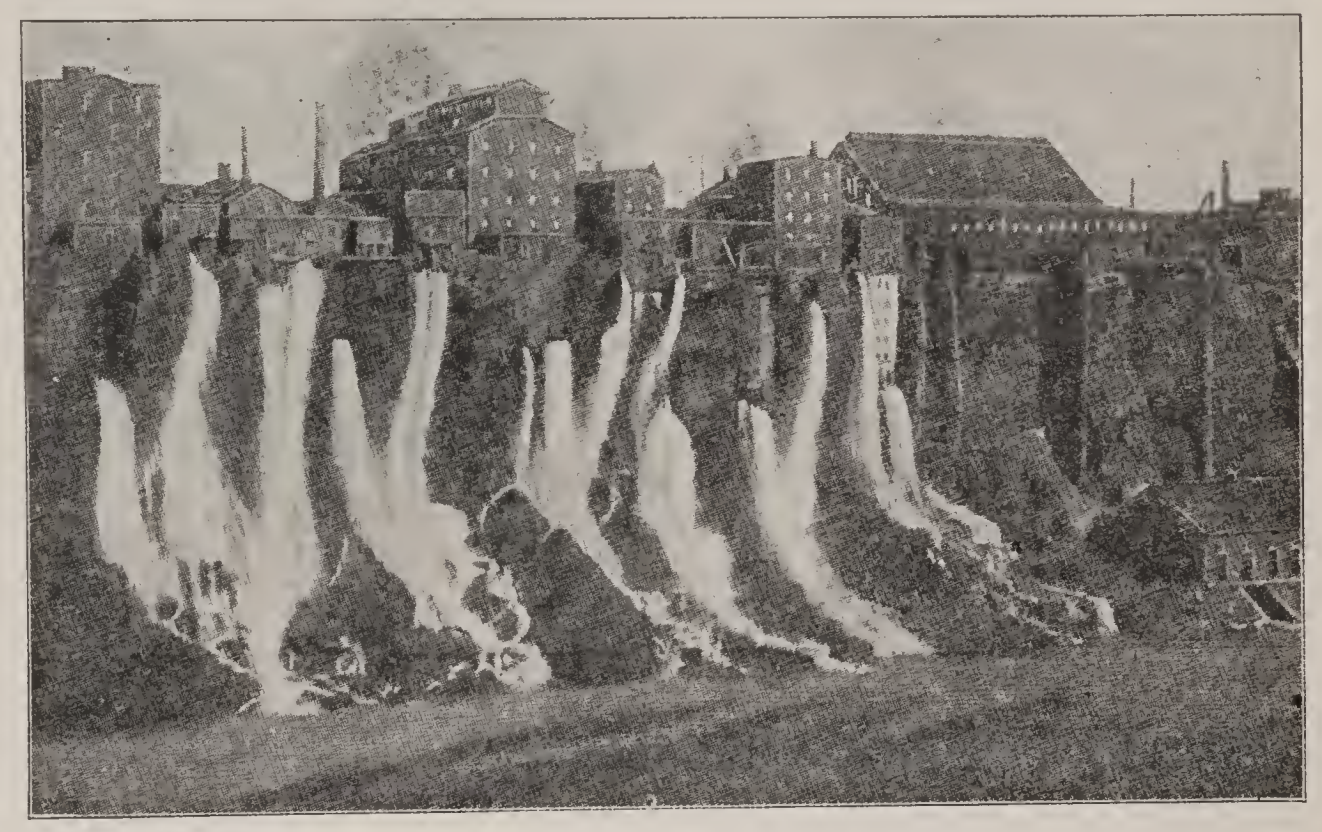
HARNESSING

Wind Water and Sun.....

How Science is turning Nature's mightiest forces into channels of usefulness, subjected and directed by the will of man. Inventions and experiments that go far toward answering the question, "What shall we do when all the World's supply of coal and oil is burned?"

It is estimated that we burn about 800,000,000 tons of coal a year, and at this rate of consumption there is enough to last a thousand years. However, it is reasonably certain that long before coal becomes so expensive that it cannot be used so universally as at the present, we shall have solved the problem of making Nature's forces work for us.

Sun, wind and water are the perpetual energies which have been under man's control in one form or other for many centuries. Windmills for drawing water, grinding grain, etc., have been used in various parts of the world for many hundreds of years. Sailing vessels is another means by which the power of the wind has been made use of. The discovery of a way to run a vessel into the teeth of the wind by the wind's own power was a great triumph.



A row of factories on the bluff below Niagara Falls, operated by water power from the River above the Falls.

Holland is foremost as the country of windmills, and here are seen many forms of wind machines doing a great variety of work. The Nebraska farmer takes advantage of the wind's power to draw the water from the reservoir of but a few feet below the arid surface, and thus irrigate the flat lands of the Platte Valley that would otherwise be a desolate waste. He, however, does not often use the factory-made windmills, but puts together old boards at the cost of little labor and a very few dollars.

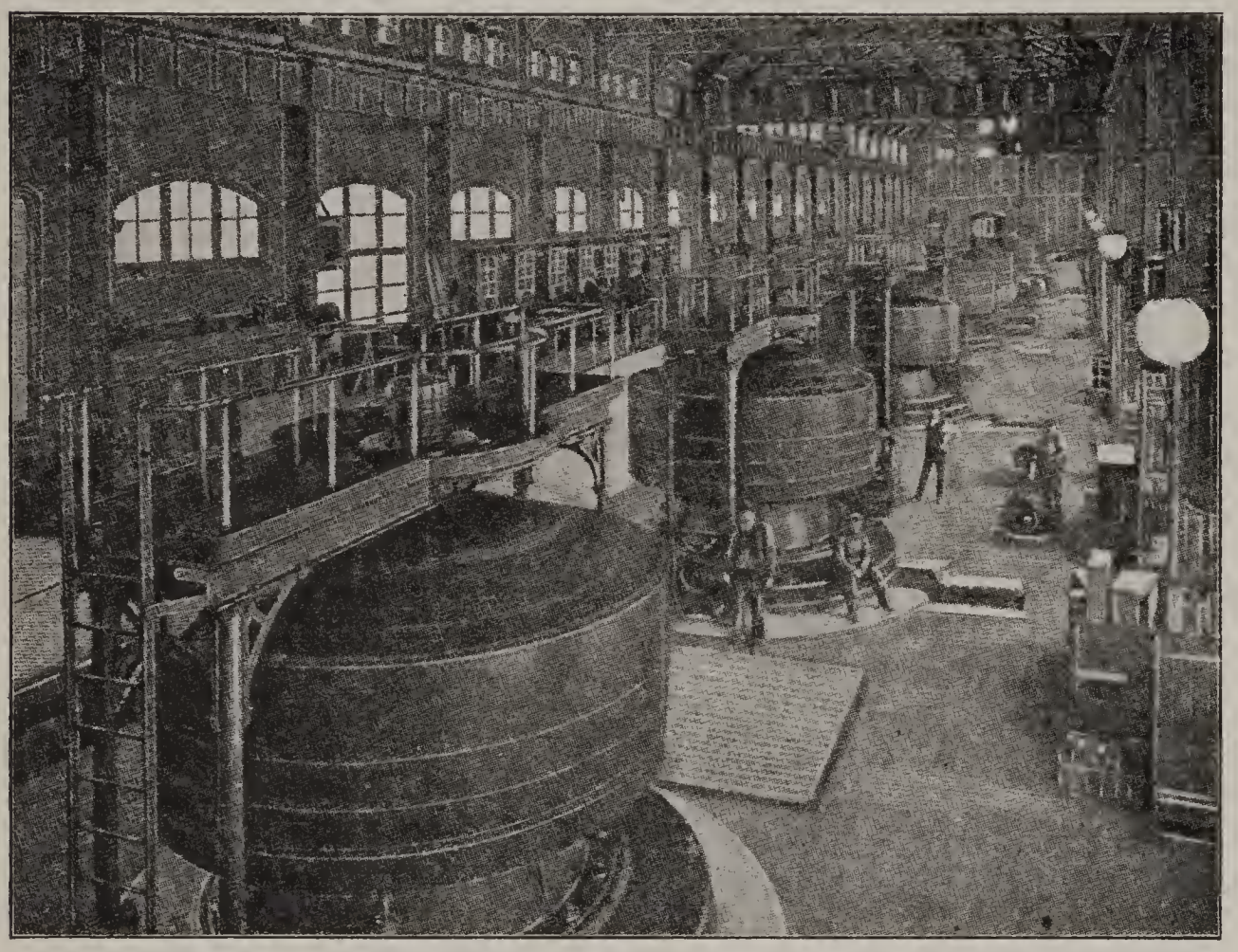
A favorite form is the "Little Jumbo." It looks like a big drygoods box, open at the top with a revolving frame half-covered by the sides. The wind carries the sails above, while the sides of the box protect those below. This sort of windmill only works when the wind is in one direction, but in the Platte Valley the wind blows north and south for nine-tenths of the time.

Streams That Turn Wheels.

The greatest natural power used by man is the waterfall and the running stream. Our forefathers harnessed the brooks to

grind their flour. In the West, however, steam has largely replaced the water wheel, but in the harnessing of Niagara Falls we are coming back to the old idea with new modifications.

The great power of Niagara Falls admits of the building of immense power plants, which transmit in the form of electricity the power gathered from the falls to a great distance, and then it can again be converted back into mechanical action. At the Buffalo Exposition the grounds were lighted by electricity carried from the power plants at the falls, and the machinery was all run by the same power. In fact, every mechanical movement and energy was dependent upon the flow of water over America's great cataract fifteen miles distant.



The interior of the room wherein the power of Niagara Falls is harnessed. The top of the shaft of each water wheel and dynamo can be seen above each frame work. This is the greatest power plant in the World.

Should there be need of greater power than that afforded by the streams of the world the mighty power of the tide which rises and falls twice a day on the shores of our great country, a force incalculable, can be harnessed and made do the work of the world as directed by man.

Mightiest Reservoir of Power.

The mightiest reservoir of power is the heat stored up in the sun. The sun's rays are the source of the imprisoned power of coal itself. So powerful are the sun's rays at mid-day on every square yard of the earth's surface there falls the equivalent of three-horse power. The sunshine on a four-acre lot at noonday represents an energy equal to that now taken from the Niagara Falls. Sufficient heat falls on the deck of a steamship, if it was all gathered and applied to the propeller, to drive the vessel along at its usual speed.

Upon an area of less than 20 miles square of the Sahara Desert pours as much heat as that contained in the 800 million tons of coal consumed each year, and nine-tenths of the coal consumed is wasted in the using. At South Pasadena in southern California is constructed a sun motor, which promises practical usefulness. The essential part of the motor is a huge umbrella-shaped glass reflector. The inner surface is made up of nearly 2,000 small mirrors, so arranged that they reflect the sunlight upon a boiler located in the center, corresponding to the handle of an umbrella. The size of this disk is $32\frac{1}{2}$ feet at its broad edge and 15 feet at the narrow edge. It is mounted on a steel frame so arranged that though the disk weighs sev-

eral tons it automatically keeps its face to the sun. Within an hour after sunrise there is sufficient steam created in the boiler to turn a centrifugal pump, which draws water at the rate of 1,400 gallons a minute. At sundown the heat no longer plays upon the boiler, and the motor stops, ready to take up its task on the coming day.

If a piece of copper is thrust in the focus of the sun's ray, it melts immediately. A piece of wood flames up as if by magic. Were a man to climb into the circle, he would be burned to a crisp in a few seconds.

This sun motor is a success, for it not only does its work but does it well and cheaply.

Gustave Couz of Hamburg, Germany, has built a wind wheel 40 feet in diameter, with a sail surface of more than a thousand square feet. It is automatically regulated to a revolution a second, and develops from one to thirty horse power, according to the strength of the wind. The wheel is harnessed to a dynamo, and produces electricity, which is carried to a storage battery, from which it can be drawn off as needed. This battery overcomes the unsteady action of the wind, and produces an even flow of the electric current for power or lighting purposes.

In Brooklyn there are three mills still standing whose wheels were once turned by the rise and fall of the tide. The power was obtained by the construction of a dam across a creek emptying into Jamaica Bay, in which a sluice gate was constructed. At high tide the water accumulated behind the dam until the gate was closed. At low tide, the imprisoned water passed swiftly down a short sluiceway to the sea, turning as it went a large undershot wheel. One of these mills is still serving the farmers of the neighborhood.

Morley Fletcher of England has invented a machine that takes the power direct from the waves. It is very much like an invert-



An old-fashioned wind-mill used for grinding grain. This is one of the most ancient of all devices for utilizing Nature's forces.

ed pump, with the piston securely anchored in a perpendicular position to the water surface. Over this piston moves a cylinder attached to a hollow tub-shaped float, which rides upon the water, and moves the cylin-

der up and down upon the piston with every rise and fall of the waves.

Thus far, this apparatus has only been

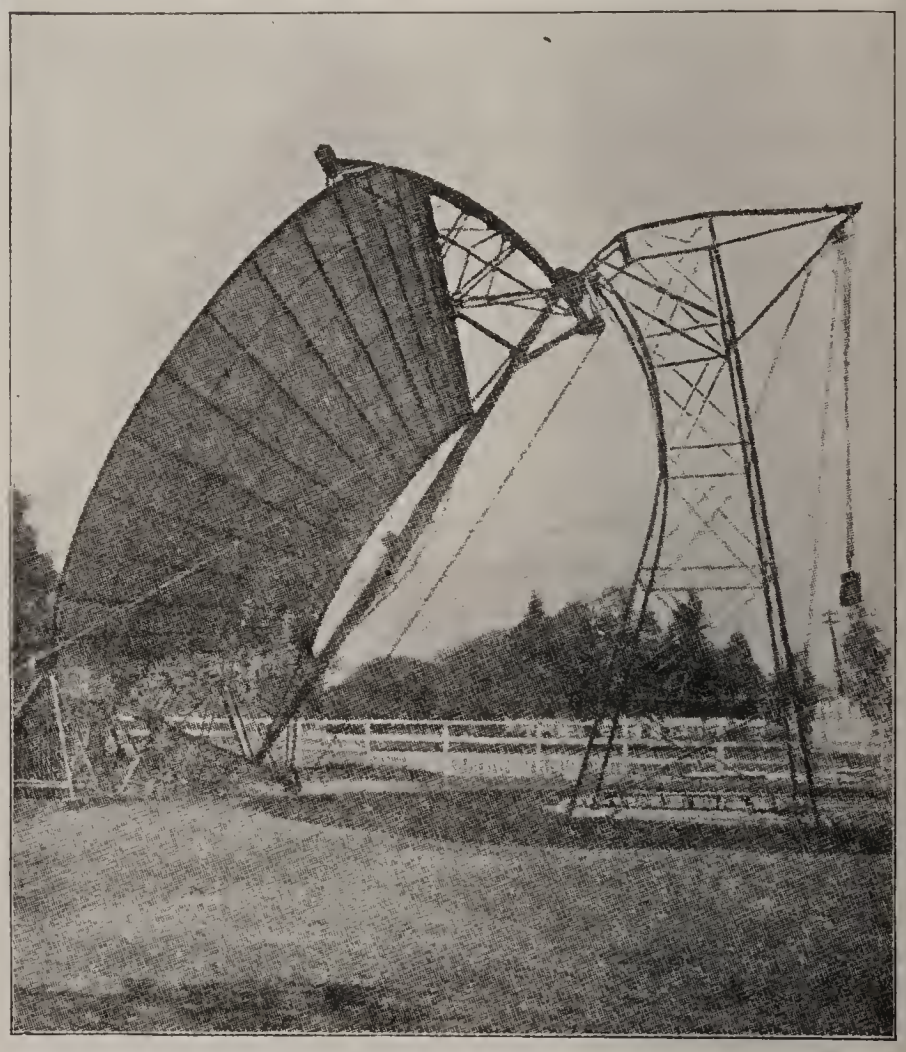


The solar motor in operation. The large umbrella-shaped disk is the reflector. The boiler is in the center, similar to the umbrella handle. The gearing shown revolves the motor, keeping it always facing the sun.

used for the blowing of fog horns off a dangerous coast. The same principle, however, could be applied to a much larger apparatus, or a multiple of such motors could be connected in a way to collect from the waves a force that could be transmitted in the form of electricity, of sufficient power to run great factories, light cities, etc.

At Potencia Beach, California, is a wave motor of different construction. An iron wharf is built out into the water about 400 feet. At the end of this wharf are three floats, each 10 feet square. These floats are permitted to move only in a vertical plane, that is, straight up and down, and are loaded so as to be considerably heavier than the water. The side of the float towards the incoming wave is inclined thirty degrees to make use of the lifting power of the water. This construction causes the float to be lifted by the power of the incoming wave, and lowered by the power of the receding waves. Attached to the float is a piston, which works in a cylinder, so that the incoming wave raises the float, lifting the piston in the cylinder, and the receding wave, together with the weight of the float, drives down the piston, forcing air into a chamber on shore. The air force in this chamber, in turn, is applied to a column of water which is directed under several hundred pounds of pressure against the edge of a water wheel. The water falls from the wheel, again to be pumped up into the chamber and renew its journey. The power it carries, however, is taken on a dynamo, which keeps in service a series of electric lights. Such an installation develops from two to three horse power for each float.

These two great natural forces, the sun motor for the interior and the tide and wave



Side view of the solar motor, showing the reflector, the mechanism that supports it, and the frame about which it revolves.

motors along the ocean shores, are the solution of the power supply of the future.

FROM CADET TO CAPTAIN

HOW TO ENTER THE NAVY AND ARMY. THE DISCIPLINE OF AN APPRENTICE, AND THE WAY TO PROMOTION.

Any boy between the ages of fourteen and eighteen, who is of sound mind and body, can become a sailor on board one of the United States war vessels, and, in time, a commander if he possesses or acquires the ability.

There has never been as many applications for places as were needed and unless there comes an unprecedented ambition among American boys for that life, the statement above will continue to hold good. Strange enough the recruiting officers prefer country boys, brought up in the sturdy life of a farm, though the boy never saw a ship on the sea.

The first necessary step is for the boy to secure the written consent of his legal guardian. It is desirable when convenient that the guardian go with the boy to the receiving ship and there make a written statement of his consent.

By writing to the U. S. Navy Department at Washington, D. C., the boy, wherever he lives, can secure blanks to be



BATTALION DRILL OF NAVAL CADETS

filled out and full directions where to apply. A boy going alone to a recruiting station, no matter how well supplied with letters and testimonials, will be severely cross-examined in order that the officers may be satisfied that he is not a runaway. If he is an unexperienced country boy, he will doubtless feel through this ordeal that he has small chance ever to become a sailor, but the officer who is thus examining him was probably undergoing this same trial not more than twenty years before.



Graduates of West Point Military Academy in encampment.

Being satisfied that the boy's application is in good faith, the officer sends him to the surgeon, who strips him and carefully examines him for any physical defects. Many boys are thus rejected who did not know that they had any defects that would debar them from the service.

He must be, at the age of fourteen or fifteen, at least four feet and nine inches tall, weigh seventy pounds and measure twenty-six inches around the chest. One who is seventeen or eighteen must be at least five feet two inches, weigh one hundred pounds and measure twenty-nine inches around the chest.

From the surgeon, the boy goes back to the captain, where he signs articles agreeing to remain faithfully in the service till he is twenty-one years of age. Then he is sent to the barber, who gives him a bath, trims his hair if needed and sends him back to the surgeon, who vaccinates him. After this he is taken to the tailor, who measures him for a uni-

form. Forty-five dollars worth of articles for his personal toilet, such as comb, tooth brush, towels, etc., are presented to him and he begins at once to draw a ration and nine dollars a month.

After being shown to his hammock, he is conducted over the ship and every part of it is explained to him. After this, he is likely to have to endure a few tricks of his mess-mates, just a little less than what might be called hazing, he has his bad spell of homesickness and wishing he hadn't done it, then he develops into a first class, well disciplined "Jackie."

He is kept on board the receiving ship until a squad of twenty recruits have been received for apprenticeship, when they are sent off to one of the training vessels.

The day begins with a bugle blast and every boy must be dressed and stow away his hammock on the upper deck within twelve minutes. They now have a cup of hot coffee, two hours and a half of exercise and then breakfast. Each one does his own laundry work and their ship must in every part be kept as bright and clean as scrubbing and rubbing can make it. There is never an idle moment, with the numerous series of drills and other training or work, until after study time, which is an hour beginning with six. The course of study includes arithmetic, geography, writ-



Sparring match for teaching the naval cadets the use of the sword.

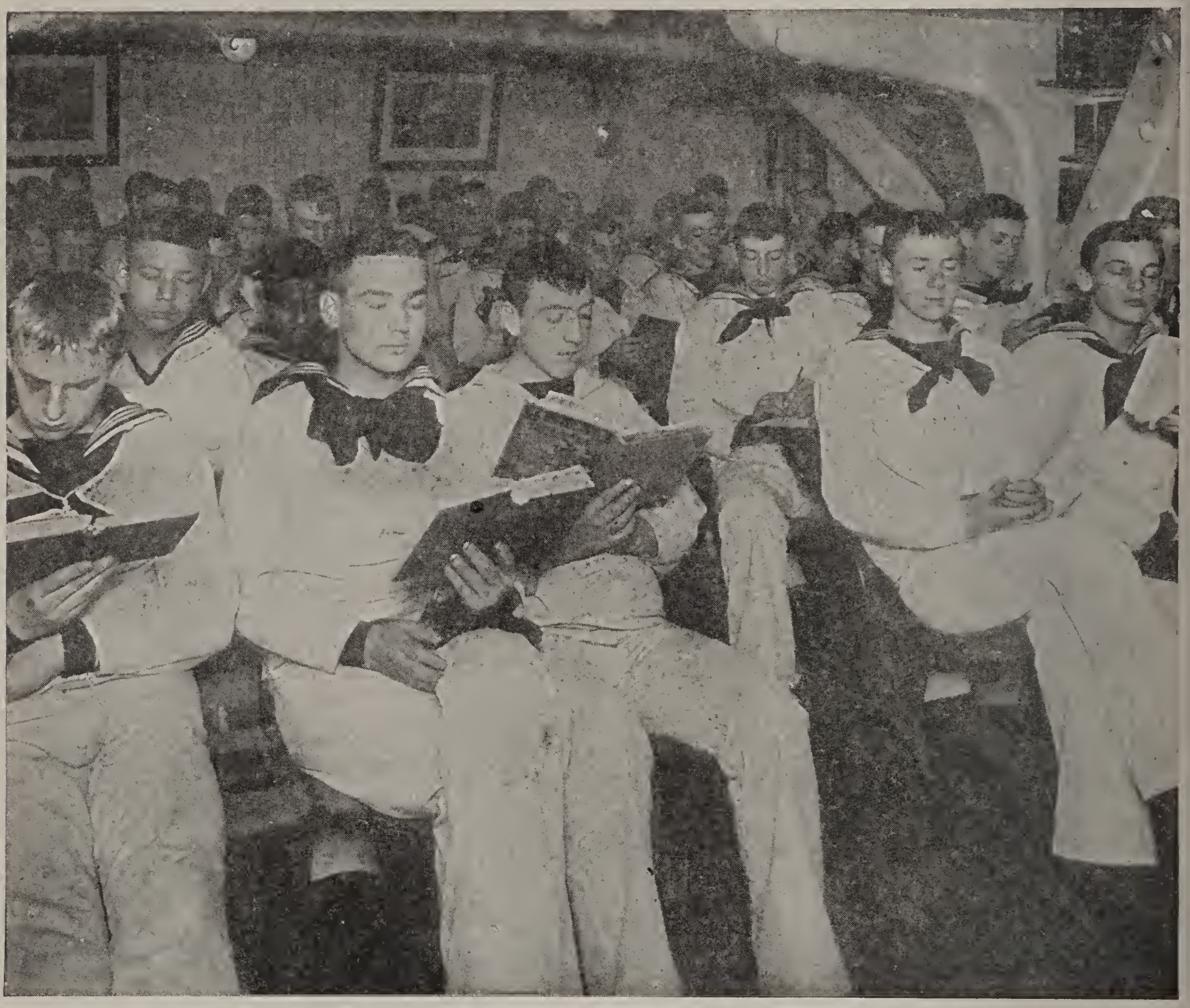
ing, history, reading, spelling and grammar.

During the hour and fifty minutes after seven, the boys can amuse themselves as they please. At the sound of the tattoo, all turn in and at nine there must be silence till six in the morning.

Saturday afternoon is a holiday devoted to any kind of amusements and sport. On Sunday there are non-sectarian religious services and a Sunday school.

After six months or a year on a stationary training ship the boys are sent cruising with a raise of wages one dollar each cruise. Usually the cruise is through the West Indies in winter and across the Atlantic in summer.

At every foreign port where there is a stop of a day or more, the boys are allowed to go ashore. When he returns from his first cruise, he is given a leave of absence for ten days in which he can make a visit to his home.



The Annapolis naval cadets studying on board the training ship.

If he has proven to be a capable and well trained sailor, he may any time after this be taken on to a man of war, with a raise to nineteen dollars a month. If he has been stupid or unruly he is likely to remain on the training ship during his entire apprenticeship.

At the age of twenty-one he is out of the service. If within three months he should desire to re-enter the service he can do so, with pay for the three months and an advance of one dollar a month in wages. Should he be regarded as deserving further advancement he may receive twenty-four dollars a month at the end of a year, and after that as much as thirty dollars.

Those who are disabled in the service receive a pension.

The naval training station is at Newport, Rhode Island, where the voluntary enlistments are received, but the naval academy, similar in respective designs to the military academy at West Point, is located at Annapolis, Maryland.

Entrance to the U. S. Naval Academy.

There is allowed for entry into this institution one naval cadet for every member or delegate of the House of Representatives, one for the District of Columbia, and eleven at large, appointed by the president. The course of the naval cadet requires four years in the academy and two years at sea.

Appointments for all skilled positions in the navy department are made from the graduates according to merit. Any boy



The United States training ship, in which the cadets from the Annapolis Naval Academy make their cruise.

ambitious to enter the naval academy, should find if the congressional district in which he lives has sent a cadet. If not, the way is clear and he should get his Con-



General Miles in the office of the Commanding General, War Department, Washington.

gressman to recommend him for appointment.

Nearly all the enlistments as naval apprentices on the training ships come from the cities. The narrowed life of strict discipline of the service has never yet been made very alluring to liberty-loving country boys.

However, appointment to the naval cadet ships in the naval academy is quite a different matter. The education and training there is advanced technical education, and both promotion and compensation are of the most desirable kind to those whose ambition is in that work.

This government training school or college for the American navy is located on the site of Old Fort Severn. The Severn river is of service in the boat drills and affords anchorage for the sea-cruisers used by the cadet. The opening of the academy took place Oct. 10, 1845, although the United States ship Constitution had been used during the previous ten years as a training ship and school.

Secretary Bancroft selected Commander Franklin Buchanan to organize the college and he remained head of the academy till he entered the Mexican war.

The cadets were removed to Fort Adams at Newport at the opening of the Civil war and the school remained there till 1865, when it was taken back to Annapolis.

Upon graduation the cadets become ensigns, second lieutenants of marines, or assistant engineers, according to the course of study pursued during the fourth year.

VOCAL CULTURE AND ELOCUTION

SO much depends on the voice in effective reading and singing that its thorough cultivation is indispensable to all who would excel in these noble arts. A sedentary mode of life, the want of invigorating exercise, close and long-continued application of mind, and, perhaps, an impaired state of health, or a feeble constitution, prevent, in many instances, the free and forcible use of those muscles on which voice is dependent. Hence arises, to students of elocution, the necessity of practicing physical exercises, adapted to promote general muscular vigor, as a means of attaining energy in vocal functions, the power of any class of muscles being dependent on the tone of the whole system.

The art of cultivating the voice, however, has, in addition to the various forms of bodily exercise practiced for the general purpose of promoting health, its own specific prescriptions for securing the vigor of the vocal organs, and modes of exercise adapted to the training of each class of organs separately.

The results of such practice are of indefinite extent; they are limited only by the energy and perseverance of the student, excepting, perhaps, in some instances of imperfect organization. A few weeks of diligent cultivation are usually sufficient to produce such an effect on the vocal organs, that persons who commence practice with a feeble and ineffective utterance attain, in that short period, the full command of clear, forcible, and varied tone.

Expanding the Chest.

Gymnastic and calisthenic exercises are invaluable aids to the culture and development of the voice, and should be sedulously practiced when opportunity renders them accessible. But even a slight degree of physical exercise, in any form adapted to the expansion of the chest, and to the freedom and force of the circulation, will serve to impart energy and glow to the muscular apparatus of voice, and clearness to its sound.

There is, therefore, a great advantage in always practicing some preliminary muscular actions as an immediate preparation for vocal exercise. These actions may be selected from the system of preparatory movements taught at gymnastic establishments, or they may be made to consist in regulated walking, with a view to the acquisition of a firm, easy

and graceful carriage of the body, with appropriate motion of the arms and limbs—in the systematic practice of gesture in its various forms, for the purpose of obtaining a free, forcible and effective use of the arm as a natural accompaniment to speech—or in the practice of attitude and action combined, in the most vivid style of lyric and dramatic recitation, so as to attain a perfect control over the whole corporeal frame, for the purposes of visible expression.

EXERCISES IN BREATHING.

Some preliminary exercises, such as the preceding, having been performed, and a sufficient period of rest and tranquil breathing having elapsed, the next stage of preparatory action may be as in the following directions:

1. Attitude of the Body.

Place yourself in a perfectly erect but easy posture, the weight of the body resting on one foot, the feet at a moderate distance, the one in advance of the other, the arms akimbo, the fingers pressing on the abdominal muscles in front, and the thumbs on the dorsal muscles on each side of the spine, the chest freely expanded and fully projected, the shoulders held backward and downward, the head perfectly vertical.

The object in view, in this apparently minute direction, is to secure perfect freedom and repose of body. A constrained or a lounging posture is utterly at variance with a free, unembarrassed use of the voice or the production of a clear and full sound.

2. Exercises in Deep Breathing.

Having thus complied with the preliminary conditions of a free and unembarrassed action of the organs, draw in and give out the breath very fully and very slowly, about a dozen times in succession. Let the breathing be deep and tranquil, but such as to cause the chest to rise fully and fall freely at every effort.

3. Effusive, or Tranquil Breathing.

Draw in a very full breath, and send it forth in a prolonged sound of the letter *h*. In the act of inspiration, take in as much breath as you can contain. In that of expiration, retain all you can and give out as little as possible—merely sufficient to keep the sound of *h* audible. But keep it going on, as long as you can sustain it. In this style of respiration the breath merely *effuses* itself into the surrounding air.

4. Expulsive, or Forcible Breathing.

Draw in a very full breath, as before, and emit it with a lively expulsive force in the sound of *h*, but little prolonged—in the style of a moderate whispered cough. The breath, in this style of expiration, is *projected* into the air. Repeat this exercise, as directed, in the statement preceding.

5. Explosive, or Abrupt Breathing.

Draw in the breath, as already directed, and emit it with a sudden and violent explosion in a very brief sound of the letter *h*—in the style of an abrupt and forcible but whispered cough. The breath is, in this mode of expiration, thrown out with abrupt *violence*. Repeat this exercise as before directed.

The habit of keeping the chest open and erect, is indispensable to the production of a full, round tone of voice. But it is of still higher value, as one of the main sources of health, animation and activity.

The effect, on the student, of the preceding exercises in breathing, is usually soon perceptible in an obvious enlargement of the chest, an habitually erect attitude, an

enlivened style of movement, a great accession of general bodily vigor, an exhilarated state of feeling, and an augmented activity of mind. To persons whose habits are studious and sedentary, and especially to females, the vigorous exercise of the organs of respiration and of voice, is, in every point of view, an invaluable discipline.

ELEMENTARY EXERCISES.

The following exercises are intended to prevent, or to correct, the prevalent errors of colloquial usage; they embrace all the elementary sounds of the English language, with the most important among those that occur in combinations which are liable to mispronunciation. A correct and careful articulation of them, if practiced with due frequency and continued for a length of time *sufficient to render accuracy habitual*, will secure a distinct and appropriate enunciation, in all exercises of reading and speaking. To attain this result, the following points require particular attention.

First.— That the exercises be always performed with great force and clearness of articulation, so as to become a useful form of discipline to the organs. The aim should be, in every case, to give *the utmost articulate force of which the voice is capable.*

Second.—The *sound* of each element should be perfectly at command, before proceeding to the enunciation of the words in which they are exemplified.

Third.—Great care must be taken to avoid a formal and fastidious prominence of sound, on unaccented syllables: every word, though uttered with the utmost energy, must retain *the proportions of accented* and *unaccented syllables* in their natural and appropriate pronunciation. It is grotesque to hear a speaker laying great stress on some unimportant syllable.

Table of Elementary Sounds of the English Language.

The elements contained in this table should be practiced, with and *without* the words in which they are exemplified, with great attention to accuracy, and repeated as a daily preliminary exercise.

Vowel Sounds.

A, as in the word Fate; *AI*, as in Ail; *AY*, as in Lay; *A*, as in Far; *AU*, as in Launch; *A*, as in Fall; *AW*, as in Awe; *AU*, as in Laud; *A*, as in Fat; *A*, as in Wash; *A*, as in Rare; *AI*, as in Air; *AY*, as in Prayer; *E*, as in Me; *EE*, as in Eel; *EA*, as in Eat; *IE*, as in Field; *E*, as in Met; *EA*, as in Head; *E*, as in Err; *EA*, as in Heard; *I*, as in Firm; *I*, as in Pine; *Y*, as in Rhyme; *I*, as in Pin; *Y*, as in Hymn; *O*, as in No; *OA*, as in Oak; *OU*, as in Course; *OW*, as in Own; *O*, as in Move; *OO*, as in Mood; *U*, as in True. *O*, as in Nor; *O*, as in Not; *O*, as in Done; *U*, as in Tub; *U*, as in Tube; *U*, as in Pull; *O*, as in Wolf.

Diphthongs.

OI, as in Oil; *OY*, as in Boy; *OU*, as in Pound; *OW*, as in Down.

Consonants.

Labial Sounds.—*B*, as in Bulb; *P*, as in Pulp; *M*, as in Mime; *W*, as in Wan; *V*, as in Vane; *F*, as in Fife; *PH*, as in Phial; *GH*, as in Laugh.

Dental Sounds.—*D*, as in Dead; *T*, as in Tent; *TH*, as in Thin; *TH*, as in Thine; *J*, as in Joy; *G*, as in Giant; *CH*, as in Church; *SH*, as in Shape; *TI*, as in Nation; *CI*, as in Gracious; *CE*, as in Ocean; *S*, as in Hiss; *C*, as in Cipher; *S*, as in Trees; *Z*, as in Haze; *S*, as in Measure.

Palatic Sounds.—*K*, as in Key; *C*, as in Cake; *CH*, as in Chorus; *Q*, as in Queen; *G*, as in Gag; *Y*, as in Ye.

Aspirate.—*H*, as in Hail.

Nasal Sounds.—*N*, as in No; *NG*, as in Sing; *N*, as in Finger, Sink.

Lingual Sounds.—*L*, as in Lull; *R*, as in Rude; *R*, as in War.

Palatic and Dental Sounds combined.—*X*, as in Ox; *X*, as in Example.

These sounds constitute all the elements of articulation in the English language. The exercises which follow are merely various examples of these rudiments as they occur in different combinations. The exercises are also designed for lessons in pronunciation, as this branch, not less than that of articulation, is much neglected in early instruction, and the practice of the one conveniently comprises that of the other.

The main purpose of reading and speaking is to communicate thought. The most important point in elocution, therefore, is a distinct and correct enunciation, without which it is impossible to be rightly and clearl understood. The chief design, accordingly, of this department of education is, by appropriate exercise, to cultivate the organs of speech, to strengthen and discipline the voice, and, at the same time, to eradicate incorrect habits of utterance which may have been contracted through early neglect.

Errors in Articulatior

The common hindrances to distinct enunciation may, as far as articulation is concerned, be classed as follows:

First.—*Feebleness*, arising from a want of full and forcible emission of voice, and of due energy in the action of the organs, particularly the tongue, the teeth and the lips.

Second.—*Omission*, a fault occasioned by undue rapidity or hurry, and sometimes by an inadvertent compliance with incorrect custom.

Third.—*Obscurity*, caused by the want of precision and accuracy in the functions of the organs, and a consequent want of definiteness or correctness in the sounds of letters and syllables.

The rule of practice, therefore, in regard to the exercises of reading and speaking, should be: *Always to articulate with such energy, deliberateness, and accuracy, that every sound of the voice may be fully and exactly formed, distinctly heard, and perfectly understood.* A drawling slowness, however, and a pedantic or irregular prominence of unaccented syllables, should be carefully avoided. Faults arising from slovenliness, and those which seem to spring from misdirected study, are equally objectionable.

PRONUNCIATION.

This department of elocution is sometimes termed *orthoepy* (correct speech). Speech being merely a collection of arbitrary sounds, used as signs of thought or feeling, it is indispensable to intelligible communication that there be a general agreement about the signification assigned to given sounds, as otherwise there could be no common language. It is equally important that there be a common consent and established custom to regulate and fix the sounds used in speech, that these may have a definite character and signification, and become the current expression of thought.

Hence the necessity that individuals conform in their habits of speech to the rules prescribed by general usage—or, more properly speaking, to the custom of the educated and intellectual classes of society, which is, by courtesy, generally acknowledged as the law of pronunciation. Individual opinion when it is at variance with this important and

useful principle of accommodation, gives rise to eccentricities, which neither the authority of profound learning, nor that of strict accuracy and system, can redeem from the charge of pedantry.

It is a matter of great importance to recognize the rule of authorized custom, and neither yield to the influence of those errors which, through inadvertency, will creep into occasional or local use, nor, on the other hand, be induced to follow innovations or changes adopted without sufficient sanction.



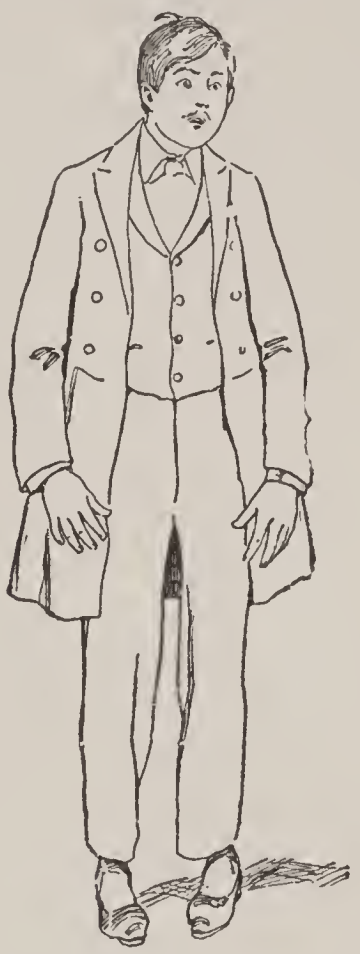
THE GRACEFUL SPEAKER.

A cultivated taste is always perceptible in pronunciation, as in every other expression of mind, and errors in pronouncing are unavoidably associated with a deficiency in the rudiments of good education.

An occasional appeal to the dictionary must, therefore, be useful to the majority of persons. Persons who are desirous of perfecting their pronunciation would do well to read aloud, daily, a few columns, and mark with a pencil those words which they find they have been accustomed to mispronounce themselves or to hear mispronounced by others.

FORCE.

A primary characteristic of utterance, as expressive of emotion, is the degree of its energy or force. The effect of any feeling on sympathy is naturally inferred from the degree of force with which the sound of voice, in the utterance of that feeling, falls upon the ear of the hearer. The cause of this impression upon the mind is, obviously, the law of organic sympathy, by which one part of the



THE AWKWARD SPEAKER.

human frame naturally responds to another. A powerful emotion not only affects the heart and the lungs, and the other involuntary agents of life and of expression, but starts the expulsory muscles into voluntary action and produces voice, the natural indication and language of feeling.

The degree of force, therefore, in a vocal sound is intuitively taken as the measure of the emotion which causes it. Except, only, those cases in which the force of feeling paralyzes, as it were, the organs of the voice

and suggests the opposite measure of inference, by which a choked and struggling utterance, a suppressed or inarticulate voice, or even absolute silence, becomes the index to the heart.

The command of all degrees of force of voice must evidently be essential to true and natural expression, whether in reading or speaking. Appropriate utterance ranges through all stages of vocal sound, from the whisper of fear and the murmur of repose to the boldest swell of vehement declamation and the shout of triumphant courage. But to give forth any one of these or the intermediate tones, with just and impressive effect, the organs must be disciplined by appropriate exercise and frequent practice, for every day's observation proves to us that mere natural instinct and animal health, with all the aids of informing intellect, and inspiring emotion, and exciting circumstances, are not sufficient to produce the effects of eloquence, or even of adequate utterance.

The want of due training for the exercise of public reading or speaking is evinced in the habitual undue loudness of some speakers and the inadequate force of others, the former subjecting their hearers to unnecessary pain, and the latter to disappointment and uneasiness.

STRESS.

The term "stress" is applied to the mode in which force is rendered perceptible or impressive in *single sounds*. The classification of the forms of stress is as follows:

First.—*Radical stress*, or that in which the force of utterance, is usually more or less "explosive," and falls on the "radical" (initial, or first) part of a sound.

Second.—*Median stress*, that in which the force is "expulsive" or "effusive," and swells out, whether slowly or rapidly, at the middle of a sound.

Third.—*Vanishing stress*, or that which withholds the "expulsive" or "explosive" force till the "vanish," or last moment of the sound.

Fourth.—*Compound stress*, or that in which the voice, with more or less of "explosive" force, touches forcefully and distinctly on both the initial and the final points of a sound, but passes slightly and almost imperceptibly over the middle part.

Fifth.—*Thorough stress*, in which the initial, middle and final portions of a sound are all distinctively and impressively marked by special "expulsive force" of voice.

Sixth.—*Tremor*, tremulous, or intermittent "stress."

MELODY.

The word "melody" may be applied to speech in the same general sense as in the technical language of music, to designate the effect produced on the ear, by the *successive notes* of the voice, in a passage of music or of discourse.

The use of this term presupposes, both in music and in speech, a certain "pitch," or initial note, whether predominating in a passage, or merely commencing it, and to which the subsequent sounds stand in the relation of higher or lower or identical.

The term "melody," used as above, does not necessarily imply a *melodious* or pleasing succession of sounds, or the reverse. It has regard merely to the fact just mentioned, that the successive sounds to which this term is applied, are comparatively higher or lower on the musical scale, or in strict unison with the first sound of a series. In this technical sense, the word "melody" applies to speech as well as to music.

PITCH.

The word "melody," used in its technical sense, occupies, then, the same ground in

elocution as in music, and refers us, in the first instance, to an initial or commencing sound to which others in a series may be compared as high or low or neither. To this sound the term "pitch" is applied, as designating the particular point of the scale, as high or low, on which the voice is thrown out. Thus, we speak of the deep tones or low notes of an organ, as contrasted with the shrill sound of a fife, of the grave tone of the voice of a man, or of the comparatively high pitch of that of a woman; or of the low voice of devotion, as contrasted with the high, shrill scream of excessive fear, or the piercing shriek of terror.

The correct practice of elocution, as in appropriate speaking, recitation, or reading, implies the power of easily and instantly shifting the "pitch" of the voice, according to the natural note of emotion required for every shade of expression depicted in the composition which is spoken, recited, or read.

Middle Pitch.

The "middle" pitch of the voice is that of our habitual utterance, on all occasions of ordinary communication in conversation or address. It implies a medium or average state of feeling, or a condition of mind free from every strong or marked emotion. It is the natural note of unimpassioned utterance, seeking to find its way to the understanding rather than to the heart, and hence avoiding high or low pitch, as belonging to the language of feeling or of fancy.

Common conversation, a literary or a scientific essay, a doctrinal sermon, or a plain practical discourse on any subject limited to purposes of mere utility, and demanding the action of judgment and reason, principally, may be mentioned as examples of "middle" pitch, which is natural in ordinary speech.

Low Pitch.

This designation applies to the utterance of those feelings which we are accustomed to speak of as "deeper" than ordinary. Low notes seem the only natural language of grave emotions, such as accompany *deeply serious and impressive thoughts*, *grave authority*, or *austere manner*.

The transition in the voice from "middle" to "low" pitch would be exemplified in passing from the utterance of a thought which is merely *serious*—and so termed in contradistinction rather to one of an animated and sprightly character—to that of one still deeper in its shade of feeling, and which would be appropriately termed *grave*. At the stage of voice expressive of the latter, we should perceive an obvious though not very strikingly marked deepening of tone, or descent on the scale.

Very Low Pitch.

This designation applies to the notes of those emotions which are of the deepest character, and which are accordingly associated with the deepest utterance. These are, chiefly, the following: *deep solemnity*, *awe*, *amazement*, *horror*, *despair*, *melancholy* and *deep grief*.

This lowest form of pitch is one of the most impressive means of powerful natural effect in the utterance of all deep and impressive emotions. The pervading and absorbing effect of *awe*, *amazement*, *horror*, or any similar feeling, can never be produced without low pitch and deep successive notes; and the depth and reality of such emotions are always in proportion to the depth of voice with which they are uttered. The grandest descriptions in the Paradise Lost, and the profoundest meditations in the Night Thoughts, become trivial in their effect on the ear, when read with the ineffectual

expression inseparable from the pitch of ordinary conversation or discourse.

High Pitch.

The higher portion of the musical scale is associated with the notes of *brisk*, *gay* and *joyous* emotions, with the exception of the *extremes* of *pain*, *grief* and *fear*, which, from their preternaturally exciting power, compress and render rigid the organic parts that produce vocal sound, and cause the peculiarly shrill, convulsive cries and shrieks which express those passions.

A "pitch" too low for the natural effect of gay and exhilarated feeling deadens the effect of wit and vivacity, and renders, perhaps, a most expressive strain of composition tame and dull, when it should abound in the tones of life and brilliancy.

Very High Pitch.

The extreme of the upper part of the musical scale, as far as it is practicable to individuals in the management of the voice, is the natural range of pitch for the utterance of *ecstatic* and *rapturous* or *uncontrollable emotion*. It belongs, accordingly, to *high-wrought lyric* and *dramatic passages*, in strains of *joy*, *grief*, *astonishment*, *delight*, *tenderness*, and the *hysterical* extremes of passionate emotion generally.

INFLECTION.

Reading without inflections becomes lifeless, as may be observed in what is usually called a "schoolboy tone." This fault not only divests language of its meaning, but substitutes a ludicrous monotony for the natural, animated and varied expression of the voice in actual communication. The hearer unavoidably loses all interest in what is monotonously read, for it makes no appeal either to his feelings or to his understanding.

There are two inflections—the rising and the falling. The falling appropriately terminates a sentence; the rising may be seen in any ordinary interrogation. The variations of voice between these two inflections prevent monotony.

The two *simple* inflections, the rising and the falling, are superseded, in the tones of keen and ironical emotion or peculiar significance in expression, by a *double* turn, or slide of voice, which unites both in one continuous sound, called the *circumflex*, or wave.

When no inflection is used, a *monotone*, or perfect level of voice, is produced. This tone belongs to emotions arising from sublimity and grandeur. It characterizes, also, the extremes of amazement and horror.

TIME.

The study of *time*, as a measure of speech, will lead to the primary classification of *single* vowel sounds as *long* or *short* in duration, according to their character and expression, as elements of language. The contrast in the duration of the "tonic element," or vowel sound, *a*, in the words *male* and *female*, will furnish examples, the *a* in the former being much longer, or, in other words, occupying a much larger space of time in utterance, than the *a* in the latter. The technical designation of this property of vocal sounds is "quantity"—implying quantity of time, or duration. The *a* of *male* is, accordingly, termed a "*long*," the *a* in *female* a "*short quantity*."

PAUSES.

Time, when applied as a measure of speech, prescribes not only the length, or "quantity," of *sounds*, but also that of the *pauses*, or cessations of voice, which intervene between sentences and between their parts, as the intermissions of the voice are, *virtually*, constituents of "expression," whether we regard

thought or feeling. Without distinct and appropriate pauses we cannot understand oral communication, and without occasional impressive cessations of voice there can be no true sympathy between speaker and hearer.

Pauses, as classified in elocution, are of two kinds: 1st, those which express *emotion;* 2d, those which modify *sense*, or meaning. Pausing, like utterance, is regulated by the character of the emotion or the thought which is the subject of expression. The pauses used in the "expression" of all *grave, deep* and *solemn* emotions, which incline to prolonged "quantities," are comparatively *long*, and thus correspond in character to the vocal sounds between which they occur, and which they aid by their harmonious effect. *Brisk, gay* and *lively* feelings are distinguished by brief "quantities" and corresponding short pauses.

The pauses of *sense* or *meaning* are of various lengths, according to the portions of speech which they are employed to separate; thus, we observe the long pauses between the principal parts of a discourse, the somewhat shorter pauses at its subdivisions, the shorter still at paragraphs, and the shorter than even these at periods.

MOVEMENT.

The term "movement," for which the word "rate" is sometimes substituted refers to the slowness or to the rapidity of utterance required by the sentiment.

The "slowest," or "very slow movement," is exemplified in the expression of the *deepest emotions* of the soul; as *horror, awe, profound reverence* and *solemnity*, and *adoration*.

The "slow movement" characterizes the utterance of *gloom, melancholy, grief, pathos, sublimity, solemnity* and *reverence*, in their usual form, *profound repose, grandeur, majesty, vastness, power* and *splendor*.

"Moderate movement" is the usual rate of utterance in unimpassioned language. It belongs to common narration and description, and to didactic thought. The rhetorical modes of style to which it is applicable, are those which are denominated the "dry," the "plain," and the "neat."

"Lively movement" implies emotion in that gentle form which does not exceed *liveliness* or *animation. The lower degrees of all vivid feeling*, are expressed by this style of "movement." A *slight* degree of *joy* is usually the under current of its effect.

Gay and Mirthful.

"Quick" or "brisk movement," is characteristic of *gay, exhilarated* and *glad* emotion: the *full* feeling of joy is implied in its "expression." It gives utterance to all *playful, humorous* and *mirthful moods*. It sometimes, on the other hand, gives its characteristic effect to *fear*.

The "movement" designated as "quickest," "very quick," or "rapid," is that of *haste, hurry, alarm, confusion* and *fear*, when rising to *terror*.

It is evident from the very nature of "movement," that it must be an element of immense power, in expression. The funeral march suggests to the ear its effect, in music, as associated with *awe, gloom* and *grief;* and the music of the dance reminds us of its power over the feelings of *gladness* and *exhilaration*. The grave psalm, and the song of serious sentiment, express, in their measured regularity, the adaptation of *gentle* and "*moderate movement*" to *tranquil* and *sedate* feeling.

The power of "movement," in the elocution of a skilful reader or speaker, is indefi-

nite; as we may observe in the difference between a schoolboy gabbling through his task, in haste to get rid of it, and a great tragedian, whose whole soul is rapt in the part of Cato uttering the soliloquy on immortality, or Hamlet musing on the great themes of duty, life and death.

A command over the "lively" and "brisk movements" of the voice, is not less important than the power of slow and solemn utterance. The style of reading which is most frequently introduced to enliven the evening circle at home, requires of the reader the power to "trip it as he goes," in the mood of *gay description*, *light satire*, *vivid dialogue* and *droll humor*.

The three principal faults of "movement," which are exemplified in the common practice of reading, are *uniform slowness*, or, perhaps, a *drawling* style; *habitual rapidity*, which *prevents* all *deep* and *impressive* effect, and, perhaps, causes *indistinctness of enunciation;* a *uniform "moderate"* "movement," which never yields to any natural influence of emotion—so as to become appropriately expressive, and pass from *grave* to *gay*, or the reverse, by a change in the gait of the voice—but utters, automaton-like, all feelings in the same unmeaning and mechanical style; the voice marching on, with one uniform measured step, over all varieties of surface, as regards the tenor of language and the subject.

EMPHASIS.

Every sentence contains one or more words which are prominent, and peculiarly important in the expression of meaning. Special force on such words is what is called emphasis. Its use is to impress more strikingly on the mind of the hearer the thought, or portion of thought, embodied in the particular word or phrase on which it is laid. It gives additional energy to important points in expression, by causing sounds which are peculiarly significant, to strike the ear with an appropriate and distinguishing force. It possesses, in regard to the sense of hearing, a similar advantage to that of "relief," or prominence to the eye, in a well executed picture; in which the figures seem to stand out from the canvass.

Emphasis, then, being the manner of pronouncing the most significant words, its office is of the utmost importance to an intelligible and impressive utterance. It is the manner of uttering emphatic words which decides the meaning of every sentence that is read or spoken. A true emphasis conveys a sentiment clearly and forcibly to the mind, and keeps the attention of an audience in active sympathy with the thoughts of the speaker; it gives full value and effect to all that he utters, and secures a lasting impression on the memory.

Errors of Emphasis.

The prevailing fault, as regards emphasis, is the *omission* or *slighting* of it.

Hence arises a feebleness of expression, or a general monotony, in consequence of which the voice fails in giving those distinctions, or conveying that force of feeling, which are inseparable from a distinct and animated manner.

An omission of emphasis leaves the sense of whole passages obscure; and an error in the application of it, may cause an entire subversion of the meaning intended to be expressed. A sentence read without just emphasis, is an inert mass of sound, like a body destitute of life; the same sentence read with the discrimination and significance of true emphasis, becomes, as it were, a living and active being, exerting its appropriate energies.

The opposite fault is that of *excessive anxiety about emphasis*, and *an unnecessary and formal marking of it by studied force of expression*.

This obtrusive tone is carefully to be avoided, as savoring of fastidiousness and pedantry, and indicating the presumption that the audience are so dull in intellect as not to appreciate the force of the speaker's language, unless he remind them of it by peculiar and pointed distinctions of voice, a thing which he does not need to do.

GESTURE.

ADDRESS, as a combination of speech and action, directs itself to the mind through the ear and the eye. Regarded as an art, it consists, accordingly, of two parts—elocution, or the regulated functions of the voice, and gesture, or the proper management of the body.

Gesture derives its existence from the necessary sympathy of mind and body. It is by no means a mere product of art. A sympathetic action of the outward frame, in correspondence with the activity of the mind, is necessarily exerted in the communication of thought and feeling, and results from a law of man's constitution. The repression of such action may, it is true, become a habitual trait in the character of individuals and of nations; so may the opposite characteristic of redundancy in gesture. Examples of these extremes are furnished in the rigid stillness of body which is customary in the elocution of Scotland or of New England, and in the ceaseless movement and gesture of the French.

Education, too, has a powerful influence on delivery. The exclusive application of the understanding, a too passive continuance of attention, or a native sluggishness of habit, indulged, has a tendency to quell or prevent emotion, and to keep back its bodily indications; while the habitual and unrestrained play of imagination, or of feeling, impels to vivid expression in tone, and to the visible manifestations of attitude and action. Hence the contrasts of manner exhibited in the



PRESENTING OR RECEIVING.

delivery of the studious and sedentary, or the phlegmatic, and that of the active, the gay, or the imaginative—both of which usually run to excess, producing the morbid style of lifelessness and inaction, or the puerile manner of mere animal vivacity.

The genuine style of eloquence is that, surely, which gives the strongest, freest and truest expression to the natural blending of thought and emotion within the human breast—breaking through all arbitrary re-



ANNOUNCING.

straint, and submitting only to the guidance of reason, or, rather, listening intuitively to its suggestions.

The common errors of judgment and taste on this subject seem to lie in the supposition that thought and feeling may be separated in their expression. Every day furnishes examples of speakers, who, from the coldness of their manner, seem to think that they can succeed in imparting sentiment without emotion, and of those whose rhetorical and mechanical warmth appears to aim at eloquence by emotion not founded on thought.

The tendency of deep interest, and of earnest, cordial emphasis, is always to impart impulse to the arm, as well as to the voice. The instruction, therefore, or the example, which inculcates the suppression of gesture, is defective and injurious, as it checks the free action both of body and mind. The unlimited indulgence in fancy, or the ungoverned expression of feeling, on the other hand, leads either to a puerile or merely passionate manner, and loses the influence of intellect in a false excitement of emotion.

A good address is that which, in the first place, may be briefly characterized by the epithet *manly*. It possesses *force*—consequently exemption from all forms of weakness; *freedom* (a natural consequence of force), implying exemption from constraint and embarrassment. These are the first and indispensable rudiments of action.

Next in importance is an *appropriate* or discriminating style—the result of genius, or of successful discipline—which adapts itself to different occasions, subjects and sentiments; varying as circumstances require, and avoiding every impropriety of manner, whether



DECLARING.

arising from personal habit or temporary inadvertency and error.

Last in order, and as a negative quality, chiefly, may be mentioned *grace*, or those modes of action which obey nature's laws of symmetry and motion, from the intuitive

perception of beauty, and the disciplined or natural subjection of the muscular system to the ascendancy of mind and taste.

These elementary principles are all that have been deemed important in the instruction attempted in the following pages. All else, it is thought, may best be left to the mind and manner of the individual—which, if not perverted or neglected, would, perhaps, render direct instruction, in any case, comparatively unimportant.

ATTITUDE.

Oratory consists of two parts—one addressing the ear through the voice, and the other, the eye by action or gesture. The latter implies a certain *attitude* of body as essential to it, and hence the necessity of attending, in the first instance, to the attitude



WONDERMENT.

or position in which the speaker presents himself to the eye. The characteristics of good attitude are *firmness*, *freedom*, *appropriateness* and *grace*.

It becomes necessary here to advert to the manner in which young speakers introduce themselves to their audience, the introductory bow being seldom what it should be—a salutation of respect, actually addressed to the assembly, but commonly a very awkward *attempt* at a bow, and one so performed as to cast down the eyes towards the floor



GLADNESS.



MEDITATION.

of the room or the feet of the speaker, and to show, not his countenance, but *the crown of his head*. A bow, or any other mark of respect (except prostration), has no meaning in it unless the eye of the individual who performs it is directed to the eyes of those to whom it is addressed.

POSITION OF THE FEET.

It is of the utmost consequence to observe a correct position of the feet, not merely because an incorrect position is ungraceful but because the easy and natural movement of every part of the body, depends on the feet being properly placed. Awkward and constrained movements of the feet, and rigid, unseemly action, are inseparable from a bad attitude. An easy and graceful position, on the contrary, favors appropriate and becom-

ing movement, and tends to render it habitual.

In the various positions of the feet, care is to be taken that the grace which is aimed at be attended with simplicity. The position of the orator is equally removed from the awkwardness of the rustic, with toes turned in and knees bent, and from the affectation of the dancing-master, whose position runs to the opposite extreme. The orator is to adopt such positions only as consist with manly and simple grace.



DESIGNATING.

The toes are to be moderately turned outward, but not to be constrained; the limbs are to be disposed so as to support the body with ease, and to admit of flowing and graceful movement. The sustaining foot is to be planted firmly; the leg braced, but not contracted; the other foot and limb must press lightly, and be held relaxed, so as to be ready for immediate change and action.

In changing the positions of the feet, the motions are to be made with the utmost simplicity, and free from the parade and sweep of dancing. The speaker must advance, retire or change almost imperceptibly; and it is to be particularly observed that changes should not be too frequent. Frequent change gives the idea of anxiety or instability, both of which are unfavorable.

Errors.

The common faults in the position of the feet, are:

First.—*That of resting on both feet equally*, which gives the whole frame a set and rigid attitude.



SILENCE.

Second.—*Pointing the toes straight forward*, which, when combined with the preceding fault, forms the climax of awkwardness and squareness of attitude, and, even when unaccompanied by any other error, has the bad effect of exposing the speaker's side, instead of his full front, and consequently assimilating all his movements and gestures to those of attack in fencing.

Third.—*Placing the feet too close* to one another, which gives the whole body a feeble and constrained appearance, and destroys the possibility of energy in gesture.

Fourth.—*The placing of the feet too widely distant, and parallel* to each other, which gives the speaker's attitude a careless and slovenly air.

Fifth.—*The placing of the feet at too wide a distance from each other, but with the one in advance of the other.* This is the attitude of assumption, or of a boasting and overbearing manner.

The observance of the different positions will produce a firm, easy and graceful attitude, appropriate to earnest and natural delivery. *In complying with rules, however, there should be no anxiety about measured exactness, and no appearance of studied precision.* Force and freedom, and general propriety of manner, are the main points to be aimed at, and strict accuracy is apt to become but a mechanical excellence.



REPULSION.

MOVEMENT OF THE FEET.

An occasional change of the position of the feet is a natural and necessary relief to the speaker in the delivery of a speech or piece of considerable length; it associates, also, in an appropriate and agreeable manner, with the introduction of a new train of thought or a new topic of discourse, and it is the instinctive expression of energy, warmth and liveliness of manner. Without movement, the speaker's body becomes, as it were, a mass of inanimate matter. Motion,



ANGUISH.



REMORSE.

when carried to excess, however, becomes childish in its effect, as it substitutes restlessness for animation.

The motion of the feet should be carefully timed, so as to occur at the commencement of the parts or divisions of a speech or discourse, at the introduction of new and distinct thoughts, or in the expression of forcible or lively emotion. The true time of movement is in exact coincidence with emphasis, and falls appropriately on the accented syllable of the emphatic word. The voice and the bodily frame are thus kept in simultaneous action with the mind.

Movement, so performed, never obtrudes itself on the attention, but becomes a natural part of the whole delivery. The changes of position should always be made (except only the retiring movement, at the close of a

paragraph or of a division of the subject) *during the act of speaking*, and not at the pauses; and even the change of posture which necessarily follows the bow, and opens the delivery of the piece, should not be made before beginning to speak, but along with the utterance of the commencing clause.



PROTECTING—SOOTHING.

All changes made before speaking, or in the intervals of speech, become apparent and formal, and particularly all preparatory motions that seem to adjust or fix the attitude of the speaker and produce the effect of suspending the attention of the audience. The frequency of movement depends on the spirit of the composition. An animated address or a declamatory harangue requires frequent movement. In a grave discourse, on the contrary, the movements are made more seldom. Poetry requires, from its vividness of emotion, many changes of position; prose, from its more equable character, comparatively few.

Your movements should always be easy and natural, never forced and constrained, never apparently studied beforehand.

MOVEMENT OF THE LIMBS.

The general air and expression of the whole body depend much on the position of the legs; as we may observe by adverting to the feeble limbs of infancy and of old age, the rigid and square attitude of men who follow laborious occupations, or the artificial display of limb sometimes acquired at the dancing-school, or exemplified on the stage.

A firm, free and graceful position of the limbs is natural to most human beings, till the influence of awkward custom, or of imperfect health, has destroyed or impaired it. Correct and appropriate posture, therefore, becomes an important point in preparatory



EXALTATION.

practice and training, intended to aid the formation of habits of rhetorical delivery.

Incorrect Attitudes.

Errors in the position of the legs occur in the following forms:

First.—*A rigid and inflexible posture,* entirely at variance with freedom and grace; causing the limbs to resemble supporting posts, rather than parts of the human frame;

and interfering with the force, ease and gracefulness of gesture.

Second.—*A feeble, though perhaps slight bending of the knees*, which gives the general attitude an appearance of timid inefficiency; and which, when accompanied, as it often is, by a sinking and rising motion, seeming to keep time to the beat of the arm in gesture, produces a childishness of mien which throws over the speaker's whole manner an air of silliness.

Third.—A fault very prevalent in public



DENYING—REJECTING.

declamation arises from overlooking the fact that *a free and natural attitude requires the knee of the leg which is not supporting the weight of the body, to fall into the natural bend of freedom and rest.* The neglect of this point—a neglect which very naturally arises from general embarrassment or constraint—has a very unfavorable effect on the whole attitude.

The influence of this attitude is quite at variance with the speaker's aim in delivery, which is to convince or persuade; the effect of which, on his attitude, would be to incline it somewhat forward, as in the natural manner of earnest address. No error, apparently so slight, is attended with so many bad consequences as this; nothing tends so much to give the speaker the air of speaking *at* his audience, rather than *to* them; yet no fault is more common in the declamation of school and college exhibitions. All that is objectionable in this attitude, however, would be done away by the speaker merely allowing the knee of the leg which does not support the body to drop into its natural bend.



DISCERNING.

MOVEMENT OF THE TRUNK.

The actions of a human being differ from the motions of a machine, chiefly in that sympathy of the entire frame which makes action appear to proceed from the whole surface and terminate in the arm, the hand, or the foot.

No gesture, therefore, seems to have life or energy unless the whole body partake in it, by a moderate yet perceptible swaying or yielding to accommodate it, and a general impulse of the muscles to enforce it, or impart to it additional and sympathetic energy.

Gesture, destitute of such aid, becomes narrow, angular and mechanical. It is of the utmost consequence, then, that the position and general bearing of the body should be free and unconstrained.

The gesture of the arms and hands must receive a slight accompanying movement of



AWE—APPEAL.

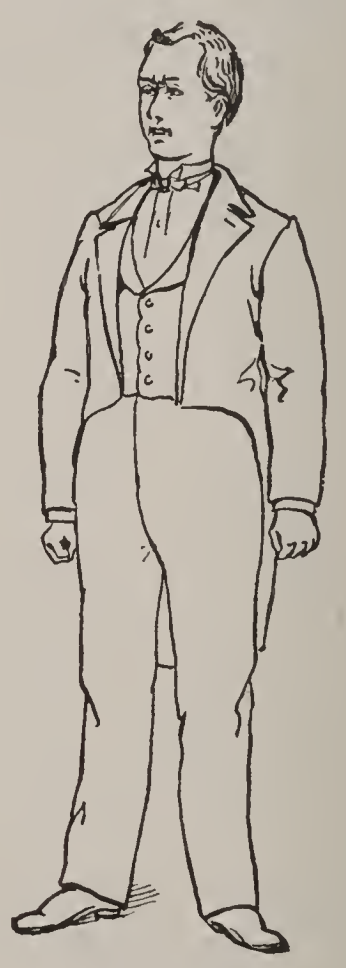
the trunk, and not proceed from it as from a rigid log. Whilst care is taken to avoid affected and ridiculous contortions, there must be a manly and free exertion of the muscles of the whole body, the general consent of which is indispensable to graceful action.

MOVEMENT OF THE HEAD AND THE COUNTENANCE.

The bearing of the head decides the general mien of the body, as haughty and condescending, as spiritless, dejected, embarrassed, or as free from the influence of such feelings, and wearing an easy, self-possessed and unassuming expression, arising from tranquility and serenity of mind. The first-mentioned of these states of feeling inclines the head upward; the second causes it to droop or keeps it fixed by constraint; the last preserves it from these extremes, and allows it an easy and natural motion.

The recitation of poetry may, in particular instances, authorize or require a very erect, or a drooping posture of the head; but declamation, or public speaking, implies a state of self-command, a rational consideration of effect, and an avoiding of the appearances of extreme emotion. In the latter exercise, therefore, the general air of the head bespeaks respect for the audience, mingling with a just self-respect, and avoids alike a lofty or a submissive carriage. The eyes and the other features correspond to this manner.

The head should neither be hung bash-



DEFIANCE.

fully down nor carried haughtily erect; it should turn easily, but not rapidly, from side to side; the eyes being directed generally to those of the persons who are addressed, but not fastening particularly on individuals.

The abstraction of the mind, implied in the appropriate recitation of some pieces of

poetry, may, however, render it inconsistent to give to delivery the air of address; as, for example, in the reciting of any passage in which a distant or imaginary scene is called up vividly to the thoughts. The eyes should, in such cases, be directed away from those of the audience and be fixed on vacancy. All inappropriate and ungraceful play or working of the features, should be carefully avoided.

POSITION AND MOVEMENT OF THE HAND.

The hand is, in most forms of action, the great organ of the mind. Its power of expression in communication, when used alone, or accompanied by speech, is peculiar and



DISPERSION.

extensive. The position or action of the hand invites, repels, refuses, rejects, implores or threatens more forcibly than even the voice or the countenance. The language and meaning of gesture lie in the hand; and these cannot be expressed without an appropriate use of this organ. The arm is, in gesture, but the inferior agent to move and exert the hand, the great instrument of all expression addressed to the eye.

The tones of the voice and the action of the features are, no doubt, the chief vehicles of meaning. But next to these comes the hand as an important agent in delivery; and in some kinds of emotion it even takes the precedence of the voice; in all those passions,



INDECISION.

for instance, which by their excess tend to render the tongue mute. In unimpassioned speaking, the gesture of the hand is not so prominent; but it still serves a useful purpose in accompanying, aiding and enforcing the impressions produced by the voice. It helps to concentrate the action of the senses toward the objects which are presented to the mind, and, though a subordinate, is yet an indispensable instrument of appropriate and impressive delivery.

The hand should be used naturally. Point with the finger; open the palm; close the hand and form a rigid fist; let the hand droop in a languid attitude; in short, *speak* with it, according to the thought or emotion you wish to express.

MOVEMENT OF THE ARM.

The freedom and force of gesture depend entirely on the appropriate action of the arm. The free play of the arm gives scope to gesture, which would otherwise be narrow, confined and inexpressive. The elevated thoughts and grand images abounding in poetry require a free, lofty and energetic sweep of the arm in gesture; but speaking which has persuasion for its object, is naturally characterized by a less commanding and less imaginative style of action.

Reasoning, arguing or inculcating, in the usual manner of speech, requires chiefly enforcing or emphatic gesture. Poetry abounds so in variety of emotion, that the action which accompanies the recitation of it is frequent and forcible, and marked by vivid transitions, with a predominance of gracefulness in the whole manner. The style of speaking adapted to prose is more calm and moderate, and more plain in its character, coinciding thus with the tenor of thought and language which usually pervades prose composition.

Action is the first, the simplest and the most striking expression of feeling. It cannot, therefore, be dispensed with, but at the risk of losing the natural animation of manner. Under the regulation of taste, it becomes a harmonious and powerful accompaniment to speech, imparting additional force to language in all its forms, and aiding a full and clear conception of what is expressed.

Gesture is not a mere matter of ornament, as is sometimes supposed. Its main object is force of impression; the beauty or grace which it imparts to delivery is but an inferior consideration. To the young learner, however, whose habits are yet forming, the cultivation of correct and refined taste in regard to gesture, is a matter of great importance.

The following are the principal gestures appropriate in address:

The *descending*, used with great energy in strong assertion and vehement argumentation, in emphatic declaration and forcible appeal.

The *horizontal* (the hand rising to a horizontal level with the shoulder), appropriate in elevated and general thought or description and in geographical and historical allusions.

The *ascending* (the hand rising to a level, nearly, with the head), expressive of sublimity of thought or feeling.

RULES FOR GESTURE.

The movement or sweep of the arm, in preparing for gesture, should always be free and graceful, but avoiding *too much extent of space*, and performed in *strict time with the movement of the voice* in utterance. The line of motion in gesture describes *a curve*, and avoids in all action but that of the humorous style a confined or angular movement.

The frequency of gesture must be prescribed by *the character of sentiment* in the piece which is spoken, and by the style of language, as moderate and plain, or impassioned and figurative; the former requiring little use of gesture, and the latter much.

All action must arise directly from *the sense of what is spoken, and never from arbitrary notions of variety or grace.* True variety is the result of a due observance of the preparatory and terminating lines of gesture; and grace consists merely in preserving these from awkward deviations.

The use of the left hand, whether singly or in conjunction with the right, depends not on arbitrary opinions of propriety or grace, but usually on necessity felt by the speaker,

either as regards himself or his audience. This form of gesture, as far as it is a matter of choice, *should be sparingly adopted.*

Gesture should be *fluent and connected*, not abrupt and desultory, or appearing and disappearing in a capricious manner.

The placing of the hand on the heart had better be omitted, if any risk must be incurred of an incorrect or objectionable action by performing it.

Gesture appropriate to the prevailing style of prose unites force and grace with simplicity, and has generally an outward and downward tendency combined; *avoiding action which runs across the body of the speaker or sweeps inwardly.*

EXAMPLES WHICH ILLUSTRATE THE PRINCIPLES OF ELOCUTION.

Declamatory Force.

FOR, as the ages, come and go,
The leaders of the van
Are proof that this is ever so—
The hour begets the man!
He's Nature's heir, and he alone
Has right and title to her throne.

Not wealth, nor yet a long descent
Through many a famous line,
Can give this power to mankind lent
From Nature's hand divine,
For with the call there comes the might
Of those who teach, or preach, or fight.

Moderate Force.

CHEERFULNESS.

IS this a time to be gloomy and sad,
When our mother Nature laughs around;
When even the deep blue heavens look glad,
And gladness breathes from the blossoming ground?

The clouds are at play, in the azure space,
And their shadows at play on the bright green vale,
And here they stretch to the frolic chase,
And there they roll on the easy gale.

And look at the broad-faced sun how he smiles
On the dewy earth that smiles on his ray,
On the leaping waters and gay young isles,—
Ay, look, and he'll smile thy gloom away.

PATHOS.

CALM on its leaf-strewn bier,
Unlike a gift of Nature to decay,—
Too rose-like still, too beautiful, too dear,—
The child at rest before its mother lay;—
Even so to pass away,
With its bright smile!—Elysium, what were thou
To her that wept o'er that young slumberer's brow?

SOLEMNITY.

THOU unrelenting Past!
Strong are the barriers round thy dark domain;
And fetters, sure and fast,
Held all that enter thy unbreathing reign.

Far in thy realm withdrawn
Old empires sit in sullenness and gloom;
And glorious ages gone
Lie deep within the shadow of thy womb.

Childhood, with all its mirth,
Youth, Manhood, Age, that draws us to the ground
And last, Man's Life on earth,
Glide to thy dim dominions, and are bound.

TRANQUILITY.

WHY weep ye, then, for him, who, having won
The bound of man's appointed years,—at last,
Life's blessings all enjoyed, life's labors done,
Serenely to his final rest has passed;
While the soft memory of his virtues yet,
Lingers like twilight hues, when the bright sun is set!

His youth was innocent ; his riper age,
  Marked with some act of goodness, every day ;
And, watched by eyes that loved him, calm and sage
  Faded his late declining years away.
Cheerful he gave his being up, and went
To share the holy rest that waits a life well spent.

SPRIGHTLY HUMOR.

SAYS Patrick to Biddy, "Good mornin', me dear,
  It's a bit av a sacret I've got for yer ear ;
  It's yersel' that is lukin' so charmin' the day,
That the heart in me breast is fast slippin' away."
"'Tis you that kin flatther," Miss Biddy replies,
And throws him a glance from her merry blue eyes.

Impassioned Force.

FEAR.

WHILE throng the citizens with terror dumb,
  Or whispering with white lips, "The foe !—
  they come, they come !"

ANGER AND SCORN.

THOU slave, thou wretch, thou coward,
  Thou little valiant, great in villany !
Thou ever strong upon the stronger side,
Thou fortune's champion, that dost never fight
But when her humorous ladyship is by
To teach thee safety.

HORROR.

GOD ! that horrid, horrid dream
  Besets me now awake ;
Again, again, with dizzy brain,
  The human life I take ;
And my red right hand grows raging hot
  Like Cranmer's at the stake.

REPROACH.

GOD is my judge ! May I never see such a look of despairing, desolate anguish, as that which the woman cast on her master, griping her breast with her little hand, as if he had stabbed her.

ANGUISH.

A WOMAN ? Yes, only a woman
  No ! surely it wasn't his wife ?
She seemed dead ! and he wrestled for freedom,
  As a doomed man will struggle for life.
"It is she ! gracious God ! Is she dying ?
  Or dead, sirs ?—say, tell if you can ?
Unhand me ! who murdered my poor wife ?"
  And a voice answered—"*Thou art the man!*"

MILITARY COMMAND.

Explosive Whispering.

HARK ! I hear the bugles of the enemy ! They are on their march along the bank of the river. We must retreat instantly, or be cut off from our boats. I see the head of their column already rising over the height. Our only safety is in the screen of this hedge. Keep close to it ; be silent ; and stoop as you run. For the boats ! Forward !

REPULSION.

DEPART ! depart, O child
  Of Israel, from the temple of thy God ;
  For He has smote thee with His chastening rod,
And to the desert wild
  From all thou lov'st, away thy feet must flee,
  That from thy plague His people may be free.

INVOCATION.

VIRGINIUS tottered nigh
  And stood before the judgment seat, and held the knife on high ;
"O dwellers in the nether gloom, avengers of the slain,
By this dear blood I cry to you, do right between us twain ;
  And e'en as Appius Claudius hath dealt by me and mine,
  Deal you by Appius Claudius and all the Claudian line."

Vanishing Stress.

EARNEST PURPOSE.

WE'VE sworn, by our country's assualters,
  By the virgins they've dragged from our altars,
By our massacred patriots, our children in chains,
By our heroes of old, and their blood in our veins,
  That living, we *will* be victorious,
  Or that dying, our deaths shall be glorious.

STERN REBUKE.

WHAT shall I say to thee, Lord Scroop, thou cruel,
  Ungrateful savage, and inhuman creature !
Thou didst bear the keys of all my counsels,
That knew'st the very bottom of my soul,
That almost might have coined me into gold,
Wouldst thou have practised on me for thy use ?"

GRIEF.

MY captain does not answer, his lips are pale and still.
  My father does not feel my arm. he has no pulse nor will.

The ship is anchored safe and sound, its voyage
closed and done,
From fearful trip the victor ship comes in with
object won;
Exult, O shores, and ring, O bells!
But I, with mournful tread,
Walk the deck, my captain lies
Fallen cold and dead.

Exercises on Pitch.

LOW NOTES.

NOT a drum was heard, nor a funeral note,
As his corse to the rampart we hurried;
Not a soldier discharged his farewell shot
O'er the grave where our hero we buried.

We buried him darkly, at dead of night,
The sod with our bayonets turning,
By the struggling moonbeam's misty light,
And the lantern dimly burning.

MIDDLE NOTES.

MY thoughts, I must confess, are turned on
peace;
Already have our quarrels filled the world
With widows and with orphans: Scythia mourns
Our guilty wars; and earth's remotest regions
Lie half unpeopled by the feuds of Rome.
'Tis time to sheath the sword and spare mankind.
We took up arms, not to revenge ourselves,
But free the Commonwealth. When this end fails
Arms have no further use. Our country's cause,
That drew our swords, now wrests them from our
hands,
And bids us not delight in Roman blood
Unprofitably shed. What men could do,
Is done already. Heaven and earth will witness,
If Rome must fall, that we are innocent.

HIGH NOTES.

BUT thou, O Hope! with eyes so fair,—
What was thy delighted measure?
Still it whispered promised pleasure,
And bade the lovely scenes at distance hail!
Still would her touch the strain prolong;
And from the rocks, the woods, the vale,
She called on Echo still through all her song:
And where her sweetest theme she chose,
A soft responsive voice was heard at every close;
And Hope enchanted smiled, and waved her golden
hair.

Exercises on Time.

SLOWEST RATE.

NIGHT, sable goddess! from her ebon throne,
In rayless majesty now stretches forth
Her leaden sceptre o'er a slumbering world,
Silence, how dead! and darkness how profound!
Nor eye nor listening ear an object finds:
Creation sleeps. 'Tis as the general pulse
Of life stood still, and Nature made a pause—
An awful pause—prophetic of her end.

SLOW.

BENEATH those rugged elms, that yew tree's
shade,
Where heaves the turf in many a mouldering
heap,
Each in his narrow cell forever laid,
The rude forefathers of the hamlet sleep.

For them no more the blazing hearth shall burn,
Or busy housewife ply her evening care;
No children run to lisp their sire's return,
Or climb his knees, the envied kiss to share.

MODERATE.

IF the relation of sleep to night, and, in some instances, its converse be real, we cannot reflect without amazement, upon the extent to which it carries us. Day and night are things close to us: the change applies immediately to our sensations; of all the phenomena of nature, it is the most obvious, and the most familiar to our experience: but, in its cause, it belongs to the great motions which are passing in the heavens. Whilst the earth glides aronnd her axle, she ministers to the alternate necessities of the animals dwelling upon her surface, at the same time that she obeys the influence of those attractions which regulate the order of many thousand worlds.

The relation, therefore, of sleep to night, is the relation of the inhabitants of the earth to the rotation of their globe: probably it is more; it is a relation to the system of which that globe is a part; and still farther, to the congregation of systems of which theirs is only one. If this account be true, it connects the meanest individual with the universe itself; a chicken roosting upon its perch, with the spheres revolving in the firmament.

LIVELY.

IN thy right hand lead with thee
The mountain nymph, sweet Liberty;
And, if I give thee honor due,
Mirth, admit me of thy crew,
To live with her, and live with thee,
In unreprovéd pleasures free:
To hear the lark begin his flight,
And, singing, startle the dull night
From his watch-tower in the skies,
Till the dappled dawn doth rise;
Then to come, in spite of sorrow,
And at my window bid good morrow,
Through the sweet briar or the vine,
Or the twisted eglantine.

QUICK.

NOW the storm begins to lower ;
(Haste, the loom of hell prepare ;)
Iron sleet of arrowy shower
Hurtles in the darkened air.

Ere the ruddy sun be set,
Pikes must shiver, javelins sing,
Blade with clattering buckler meet,
Hauberk crash, and helmet ring.

Sisters, hence with spurs of speed!
Each her thundering falchion wield ;
Each bestride her sable steed :
Hurry, hurry, to the field!

Exercises on Inflection.

FALLING.

WHEN night
Closes round the ghastly fight,
If the vanquished warrior bow,
Spare him ;—by our holy vow,
By our prayers and many tears,
By the mercy that endears,
Spare him !—he our love hath shared ;—
Spare him, as thou wouldst be spared !

RISING.

BUT while they sit contriving, shall the rest,
Millions that stand in arms, and longing wait
The signal to ascend, sit lingering here,
Heaven's fugitives, and for their dwelling-place
Accept this dark opprobious den of shame,
The prison of his tyranny who reigns
By our delay !

Exercises in Movement.

SLOWEST.

I HAD a dream which was not all a dream.
The bright sun was extinguished ; and the stars
Did wander darkling in the eternal space,
Rayless and pathless ; and the icy earth
Swung blind and blackening in the moonless air ;
Morn came, and went—and came, and brought no day.
The world was void ;
The populous and the powerful was a lump,—
Seasonless, herbless, treeless, manless, lifeless,—
A lump of death—a chaos of hard clay.
The rivers, lakes, and ocean, all stood still ;
And nothing stirred within their silent depths.
Ships, sailorless, lay rotting on the sea ;
And their masts fell down piecemeal : as they dropped
They slept on the abyss without a surge ;—
The waves were dead ; the tides were in their grave ;
The moon, their mistress, had expired before ;
The winds were withered in the stagnant air ;
And the clouds perished : Darkness had no need
Of aid from them—She was the universe.

SLOW.

ANON out of the earth a fabric huge
Rose like an exhalation, with the sound
Of dulcet symphonies, and voices sweet,
Built like a temple, where pilasters round
Were set, and Doric pillars, overlaid
With golden architrave ; nor did there want
Cornice, or frieze, with bossy sculptures graven ;
The roof was fretted gold. Not Babylon,
Nor great Alcairo, such magnificence
Equalled in all their glories, to enshrine
Belus, or Serapis, their gods ; or seat
Their kings, when Egypt with Assyria strove
In wealth and luxury. The ascending pile
Stood fixed her stately height ; and straight the doors
Opening their brazen folds, discover wide
Within, her ample spaces, o'er the smooth
And level pavement : from the arched roof,
Pendent by subtle magic, many a row
Of starry lamps, and blazing cressets, fed
With naphtha and asphaltus, yielded light.

MODERATE.

THE city and republic of Carthage were destroyed by the termination of the third Punic war, about one hundred and fifty years before Christ. The city was in flames during seventeen days ; and the news of its destruction caused the greatest joy at Rome. The Roman senate immediately appointed commissioners, not only to raze the walls of Carthage, but even to demolish and burn the very materials of which they were made ; and, in a few days, that city, which had once been the seat of commerce, the model of magnificence, the common storehouse of the wealth of nations, and one of the most powerful states in the world, left behind no trace of its splendor, of its power, or even of its existence.

The history of Carthage is one of the many proofs that we have of the transient nature of worldly glory : for, of all her grandeur, not a wreck remains. Her own walls, like the calm ocean, that conceals forever the riches hid in its unsearchable abyss, now obscure all her magnificence.

ANIMATED, OR LIVELY.

I HAVE lived to see generals who once had crowds hallooing after them wherever they went, who were bepraised by newspapers and magazines,—those echoes of the voice of the vulgar ; and yet they have long sunk into merited obscurity, with scarce even an epitaph left to flatter. A few years ago, the herring fishery employed all Grub street : it was the topic in every coffee-house, and the burden of every ballad.

We were to drag up oceans of gold from the bottom

of the sea we were to supply all Europe with herrings, upon our terms. At present, we hear no more of all this We have fished up very little gold that I can learn; nor do we furnish the world with herrings, as was expected. Let us wait but a few years longer, and we shall find all our expectations a herring-fishery.

GAY, OR QUICK.

AND gaiety on restless tiptoe hovers,
Giggling with all the gallants who beset her;
And there are songs and quavers, roaring, humming,
Guitars, and every other sort of strumming.

And there are dresses, splendid, but fantastical,
Masks of all times and nations, Turks and Jews,
And harlequins and clowns, with feats gymnastical,
Greeks, Romans, Yankee-doodles, and Hindoos.

RAPID, OR QUICKEST.

AWAY!—away!—and on we dash!—
Torrents less rapid and less rash.
Away, away, my steed and I,
Upon the pinions of the wind,
All human dwellings left behind:
We sped like meteors through the sky,
When with its crackling sound the night
Is chequered with the northern light:—
From out the forest prance
A trampling troop—I see them come!
A thousand horse—and none to ride!—
With flowing tail, and flying mane,
Wide nostrils, never stretched by pain,
Mouths bloodless to the bit or rein,
And feet that iron never shod,
And flanks unscarred by spur or rod—
A thousand horse,—the wild, the free—
Like waves that follow o'er the sea,
Came thickly thundering on:—
They stop,—they start—they snuff the air,
Gallop a moment here and there,
Approach, retire, wheel round and round,
Then plunging back with sudden bound—
They snort—they foam—neigh—swerve aside,
And backward to the forest fly,
By instinct, from a human eye.

Exercises in Pauses.

[In the following examples the upright parallels show the length of the pauses and where they should be made.]

ALARM AND FEAR.

AND all went merry as a marriage bell:
But hush! || || hark! || || a deep sound || strikes like a rising knell!

AWE AND TERROR.

MANY ports will exult at the gleam of her mast:
Hush! || hush! || thou vain dreamer! || this hour || || is her last. || ||
Her keel hath struck on a hidden rock; |
And her planks are torn asunder: |
And down come her masts with a reeling shock, ||
And a hideous crash|| like thunder!

HORROR.

SLOWLY knee to earth he bent,—his father's hand he took— || ||
What was there in its touch, that all his fiery spirit shook? || ||
That hand was cold! || || a frozen thing:— || || it dropped from his like lead! || ||
He looked up to the face above—|| the face was of the dead. || ||

A plume waved o'er the noble brow— || that brow was fixed and white: || ||
He met, at last, his father's eyes— || || but in them was no sight! || ||
Up from the ground he sprang, and gazed— || || but who could paint that gaze? ||
They hushed their very hearts, || that saw its horror and amaze.

STILLNESS, AND AWE.

CREATION sleeps: || || 't is as the general pulse of life | stood still ||
And nature made a pause, || an awful pause, || |
Prophetic of her end!

SOLEMNITY, AND TRIUMPH.

THE stars | shall fade away, || the sun himself |
Grow dim with age, || and Nature | sink in years;
But thou | shalt flourish in immortal youth, ||
Unhurt | amidst the war of elements, ||
The wreck of matter, || and the crush of worlds.

GRIEF.

O FAIREST of creation! || last | and best |
Of all God's works, || creature in whom excelled
Whatever can to sight or thought be formed,
Holy, | divine, | good, | amiable, | or sweet! ||
How art thou lost, || || how on a sudden lost, ||
Defaced, || deflowered, || and how to death | devote!

HORROR.

SO completely did these masters in their art, Hyder Ali, and his more ferocious son, absolve themselves of their impious vow, that when the British armies traversed, as they did, the Carnatic, for hundred of miles, in all directions,—

through the whole line of their march, | they did not see one man, | not one woman || not one child, || || not one four-footed beast || of any description whatever. One | dead | uniform | silence || reigned | over the whole region.

ORATORICAL INTERROGATION.

WHO'S here so base that would be a bondsman? — || If any, speak; for him have I offended. || || Who's here so rude, that would not be a Roman? — || If any, speak; || for him have I offended. || || Who's here so vile, that will not love his country? — || If any, speak; || for him have I offended. — || || I pause for a reply

Exercises in Emphasis.

FIERCE ANGER AND DEFIANCE.

CALL me their *traitor!*—Thou *injurious* tribune!
Within thine eyes sat *twenty thousand deaths*,
In thine hands clutched as many MILLIONS, in
Thy longing tongue BOTH numbers, I would say,
Thou *LIEST*, unto thee, with a voice as free
As I do pray the gods.

ANGER AND THREATENING.

YOU souls of *geese*,
That bear the *shapes* of men, how have you run
From *slaves* that *apes* would beat!—PLUTO and HELL!
All hurt *behind; backs red*, and *faces pale*
With *flight* and *agued fear!*—MEND, and CHARGE HOME,
Or by the *fires* of *heaven*, I'll *leave* the FOE,
And make my wars on YOU: *look to't:* COME ON!

DEFIANCE.

WHAT in the world he is,
That names me *traitor*, villian-like he LIES:
Call by thy trumpet: he that dares approach,
On *him*, on YOU,—WHO NOT?—I will maintain
My *truth* and *honor firmly*.

EMPHATIC PHRASES.

UPON the *whole*, I will beg leave to tell the House in a *few words* what is *really my opinion*. It is, that the Stamp Act ought to be *repealed* — ABSOLUTELY — TOTALLY — and IMMEDIATELY.

2. And were I an *American*, as I am an *Englishman*, while a *single foreign troop remained* in my *country*, I would *never* lay down my arms—NEVER—NEVER—NEVER.

COMPARISON AND CONTRAST.

IN *Homer*, we discern all the Greek *vivacity;* in *Virgil*, all the Roman *stateliness*. *Homer's* imagination is by much the more rich and *copious; Virgil's* the more *chaste* and *correct*. The strength of the *former* lies, in his power of *warming* the *fancy;* that of the *latter*, in his power of *touching* the *heart*. *Homer's* style is more *simple* and *animated; Virgil's* more *elegant* and *uniform*. The *first* has, on many occasions, a *sublimity* to which the *latter* never *attains;* but the *latter*, in return, never *sinks below* a certain degree of *epic dignity*, which cannot so clearly be pronounced of the *former*.

STRONG ANTITHESIS.

GET any man resolve to do right *now*, leaving *then* to do as it can: and if he were to live to the age of Methuselah, he would never do wrong.—But the common error is to resolve to act right *after breakfast, or after dinner, or to-morrow morning, or next time*. But *now*, just *now*, this *once*, we must go on the same as ever.

THE DELSARTE SYSTEM
OF
PHYSICAL CULTURE AND EXPRESSION

EASE and naturalness are among the chief requisites for effective reading and reciting on all occasions. There is a natural way of expressing every thought and emotion. Mind and body should work together in perfect harmony. Delsarte aims to show how this can be done.

To the uninformed, his name stands hazily for some kind of mysticism. The simple fact is, that there is no more mysticism connected with his teachings and philosophy than there is about any philosophy which has to do with mind rather than with matter.

It would be impracticable here to give an exhaustive account of Delsarte's life and philosophy, even were that possible. The object will be simply to state such facts as will enable the young student of the art of expression to understand why "Delsarteism," popularly so-called, exercises the authority it does.

In this particular field Delsarte was the greatest teacher of modern times, and the only one who can be said to have attained to a philosophy of expression. He did not leave, nor did he even formulate, a pedagogical method, but he did formulate and leave rules and principles that are fundamental.

Birth and Early History.

François Delsarte was born November 11, 1811, at Solesmes, France. Early orphaned and impoverished, he drifted like many another waif to Paris, where, in the bitter winter of 1821, he lived in a loft with his younger brother. As morning dawned after one awful night, he woke to find he clasped a lifeless body in his arms. Hunger and exposure had proved fatal to the younger child. As François lay weeping on the grave of the brother just buried in the potter's field, a ragpicker, pursuing his calling, was attracted by what appeared to be a bundle of rags. He found the object to be a half-starved child. Moved with compassion, he took the lad to his own miserable abode, and from this squalor the future teacher and philosopher began his career as a ragpicker.

For two years he followed his wretched avocation, but within his soul burned the passion for music, and in his daily wanderings he gratified his passion as best he could,

drinking in the ditties of itinerant vocalists, the playing of military bands, snatches of songs, or instrumental performances that floated truant to his hungry ear.

At twelve, attracted by music in the garden of the Tuileries, he was observed tracing some curious marks in the sand by one of the musical masters of the time—Bambini. At the request of the professor, the boy translated his hieroglyphics into song. To the question as to where he learned them, he replied, "Nobody taught me sir, I found it out myself." Bambini recognized genius. He took the lad to his home and began his education in music. During two years, such was the progress of the boy, that "Bambini became the pupil, Delsarte the teacher."

Poor and Friendless.

Just then came a great misfortune—the death of his kind protector. Fortunately Bambini had secured Delsarte's admission to the Conservatory. Again, poor and friendless, he had to face the world. He was not a favorite at the Conservatory, because he dared to question the methods of the professors, reputed as they were. In after life he proved their methods incorrect and injurious.

In consequence of what they termed his audacity, he was given little opportunity for public singing, and when occasion was afforded, his style and manner were so essentially unlike the methods of the Conservatory, that the public were not prepared for approval. We are told that only two persons of the vast audience comprehended and appreciated, but the opinion of those two overbalanced all the rest—Marie Malebran, the "queen of song," and Adolphe Nourrit, "the king of tenors."

In due time he left the Conservatory. Failing to obtain a position, he was forced to subject himself to the humiliation of asking the directors for a diploma that he might secure a position in a lyric theatre. He was scornfully refused and told that "such genius should have gravitated to its proper sphere without difficulty or without assistance."

Then he sought opportunity to sing at the Opera House, begging the manager for just one chance. When the latter eyed him contemptuously, Delsarte, sensitive and keenly observant, said, "Monsieur, though my clothes are poor my art is genuine."

A Brilliant Triumph.

The manager, tired of his persistence and anxious to be rid of him, ushered him upon the stage between the acts of an opera and roughly addressed him: "Sing, Delsarte! In five minutes the curtain will rise. Show the stuff you are made of, or if you ever appear here again I will have you arrested as a vagrant."

And we are told that the "beggar with the manners of a prince" walked to the piano amid the jeers of the audience, and with tears in his eyes and his heart on his lips, sang. But what singing! "The long pent-up fires of his genius burst forth. The people were electrified; the house rang with bravos. Again and again he was recalled, and every heartstring was made to vibrate in unison with his soulful utterances. He left the threatre the first singer of Paris."

Soon after this, neatly attired and bearing his appointment at the Opera Comique, he made a brief call at the Conservatory to confirm the directors in their judgment that "true genius should find its proper sphere." He gave tangible proof of it in his commission, and smiling, pointedly observed, "Gentlemen, you would not give me a recommendation as a chorister, but the public have awarded me this." This occurred in 1830.

He soon won a European reputation. But his voice, injured by incorrect methods of training and the physical strain of years of hardship, lost its power, and he left the lyric stage at the age of twenty-three. In spite of this, every inducement was given him to appear in tragedy with Rachel at the Theatre Français, the belief prevailing that his vocal difficulties were but temporary.

He believed them incurable, and turned his attenttion to acting, because deeply interested in expression as an art. He determined to search the laws of an art hitherto left to the "caprice of mediocrity or the inspiration of genius." He found little to aid him in the accepted teachings of the time and was left to pursue his investigations according to his own independent methods.

The World His Schoolroom.

The true genius of the man led him to the right fountain—nature, the only fundamental source. He studied life and its natural expression in all its manifestations, in all conditions, and such a course of study took him everywhere—through hospitals, morgues, asylums, prisons, patiently unearthing the sentiments of past genius.

He studied children at their play, weighing humanity everywhere and in every way. He studied years in medical colleges to understand the construction of the human body. He studied a lifetime to formulate its expression, to convey through the body, beautifully and rythmically, the sentiments of the soul. He was a keen observer and a careful thinker and reasoner. After years of observation of the manifestations of the mind through the body, he sought for the underlying philosophy of these manifestations.

All this time he was teaching, and among his pupils were Rachel, Carvalto, Macready, Pasca, Sontag and Barbot. Jenny Lind consulted him. Pere Hyacinth and Pere Lacordaire, of pulpit fame, were also among his pupils.

He became so great a teacher that he won a recognition that would have brought him wealth and a fame more widely understood and recognized, had not death cut short his career. He was offered an annual salary of $20,000 to found a conservatory in the United States. The King of Hanover, recognizing him as an artist, sent him the Guelph Cross. A street in his native town, Solesmes, was named in his honor.

His Own Words.

His last public appearance was in 1865, at the Sorbonne, where the lectures of the Philotechnique Society were given.

It is recorded that during the evening he remarked: "Many persons feel confident they are to hear me recite or sing. Nothing of the sort, gentlemen; I shall not recite and I shall not sing, because I desire less to show you what I can do than to tell you what I know. I count on the novelty—the absolute novelty—of the things I shall teach you. Art is the subject of this conversation. Art is divine in its principle, divine in its essence, divine in its action, divine in its aim. Ah! gentlemen, there are no pleasures more lasting, more noble, and more sacred than those of art.

"Let us glance around us. There is not a pleasure which is not followed by disappointment or satiety; not a joy which does not entail some trouble; not an affection which does not conceal some bitterness, some grief, and often some remorse. Everything is disappointing to man. Everything about him changes and passes away. Everything betrays him. Even his senses, so closely allied to his being and to which

he sacrifices everything, like faithless servants betray him in their turn."

Delsarte married, in 1833, Rosina Adrien, the daughter of the director of the Grand Opera House—a beautiful young girl of only fifteen years, whose talent as a pianist had already won her a first prize at the Conservatory. Seven children were born to them. His son Gustave died prematurely. It is said of him that, although not approaching his father as a dramatist, he had a most marvellous quality of voice, and when you had once heard that voice, which was developed by his father's grand method, you never forgot its sincerity and melancholy. It haunted you and left you longing to hear it again.

Delsarte left Paris with his family in 1870, taking refuge until the close of the war in his native town of Solesmes. Already ill, he was disheartened and crushed by the misfortunes of his country. He worked steadily on, however, his intellect having lost none of its vigor, though his nature had become more or less shadowed. After his voluntary exile he returned to Paris in March, 1871.

"After Delsarte had gathered so abundant a harvest of laurels, fate decreed he had lived long enough. When he reached his sixtieth year he was attacked by hypertrophy of the heart, which left his rich organization in ruins. He was no longer the artist of graceful, supple expression and harmonious movements, no longer the thinker with profound and luminous ideas; but in the midst of this physical and intellectual ruin, the Christian's sentiment retained its strong, sweet energy.

"After lingering for months in a state that was neither life nor death, surrounded by his pious wife and weeping, praying children, he surrendered his soul to God on the 20th of July, 1871."

What Delsarte Taught

DELSARTE was a man of religious feeling, and knew religious books better than other books. He was acquainted with the lore of the priests, to which he was indebted for his philosophy. Tradition affirms that he was much interested in, and studied Swedenborg. This theory is confirmed by the fact that certain fundamental ideas in his philosophy and the expression of them are intrinsically Swedenborgian.

One of the fundamental principles of Delsarte's philosophy is the law of correspondence, which was discovered by Swedenborg, who held that the material world corresponds to the spiritual world and is the manifestation of man's mental being. In other words, that the spiritual world is symbolized in the physical world. Applied to expression, the interpretation of this law is: "Every expression of the face, every posture of the body, corresponds to, or is but an outward expression of, an inner emotion or condition of the mind."

Goldsmith has pithily said that "language was invented to conceal our thoughts," and the truth of this every one knows by personal experience; but there is a revealer that the will is not always strong or alert enough to control. The involuntary gesture reveals the inmost heart of man beyond all concealment or denial.

In the correspondence of the different parts of the body, Delsarte's idea was not that mental and moral atrributes dwell in these parts, but that certain parts best represent, best express, certain attributes. For example, the head in its poise, etc., represents intellect better than any other part of the body; the trunk, affection; the limbs, power. Each part can represent a certain attribute better than it can represent other attributes.

We See It Illustrated.

For proof of the fundamental truth of this principle we need appeal only to our intuition, the highest of all the powers of judgment, exercising it upon the familiar illustration of everyday life and expression. The mother presses her child to her breast in token of affection, not to her head or to her arms. The head is bent in thought. We encircle a friend with the forearm in friendly demonstration, not with the upper arm; with that we push aside. In this short discussion only the merest index to lines of thought can be suggested to the student.

Delsarte held that in gesture or movement of the body, the parts should move in opposition. In proof of the correctness of his theory he appealed, as before, to the intuition, judging by common observation. When walking normally, the right arm goes forward with the left foot. Parallelism offends our idea of fitness and grace. Opposition of movement marks not only beauty but sincerity, according to his ideas, and these things prove themselves by their appeal to our observation.

The workings of this law can be demonstrated and proven through all parts of the body—there is opposition everywhere. It has been claimed by some that Delsarte did not announce this as a law, but close students of his philosophy, for whom there was access to his notes, find sufficient evidence that he so regarded it. Delsarte was too close an observer and too long a student of the manifestations of the human body not to perceive this very evident principle of action.

Fundamentally, underlying the law of opposition, is the law of equilibrium. To maintain equilibrium of parts there must be opposition. Again, another great teacher in support of this law has called our attention to a fact of common observation: "In true acting you will see opposition of movement; in a farce, parallelisms. In the highest Greek art, the law of opposition is fully illustrated and strictly followed; one of the features which distinguishes ideal Greek art from the lower forms is the obedience to this law. In the old Egyptian statues, the arms and legs are always parallel. In the Phidian, the highest period of Greek art, not one instance of disobedience to the law of opposition can be found."

Another law of movement which claims the student's attention is that of

Succession.

"If two parts are used at the *same time*, they move in opposition; but, if moved successively, as to time, they move in the same direction—parallel directions." For example, if a cultivated person hears something when listening, the eye is turned away from the ear; when he turns toward the direction of the sound to examine, the eye is turned first, then the head, then the body.

The uncultivated person turns all at once—has no parts. The uncultivated body moves in the mass, is lumbering, stiff, in one word, awkward. The cultivated body is supple and responsive to mental impulses; in one word, graceful. Thus ease and nat-

uralness always exhibit themselves in persons who have all their powers under control, and have reached the highest point of mental and physical training.

Another law relating to movement involves this idea: "Every gesture takes its value from the point of departure—it is mental, moral, or vital, according to its point of departure."

A gesture of mentality takes its point of departure from the head. A gesture takes its moral value from the chest as a point of departure. The gesture of vitality is from the vital part of the body. If the emotion be anger, and intellectual anger, because of opposition to truth, the finger will come up to the head—"I declare this to be so and so." If the anger involve the sense of right, the point of departure will be the region of the heart. If the offense be physical, the gesture will be low, in the region of the hips. Then there is the law of

Unity of Movement.

No part acts alone. The parts assist one another, and thus in the matter of gesture confirm one another; otherwise, there would be discord and lack of symmetry.

In this line Delsarte did a great deal of pioneer work, and those who have followed his methods have had much work to do properly and thoroughly to insist upon this law of action, obvious as it is.

Should any agent of the body make a gesture which the other parts of the body seem to deny, there is evident mental disagreement and physical awkwardness. The gesture will seem not suitable to the thought, although upon close discrimination the leading agent will be found to be responding correctly.

Many an actor and public reader has been termed untrue and justly termed awkward because of a lack of unity in all the parts taken together.

This is the fundamental law of all grace and beauty in nature. "No part of the body is used without a definite purpose in view, and no part is used more than is absolutely necessary to the end sought."

Awkward People.

This law, as do all these fundamental laws of nature, appeals to our intuition for proof. The awkward, clumsy person moves parts not necessary to the action, indulges in superfluous movements and finds himself in his own way.

Following close in logical sequence and inseparable in action, is the law of *centers*, radically involving the preceding law. "The center seems to impel all the other parts. That which impels the whole body is the center of the chest." Note that the upright, easy, graceful walker seems impelled by the chest. Should the head lead, we have a mincing, weak walk. If the hips lead, there is an appearance of vulgarity. Obedience to this law secures grace.

These laws, as has been indicated, prove themselves, and their collaboration and application in the art of expression show the careful and extensive observation and philosophical generalization of Delsarte's thought and work. These are the laws underlying his philosophy.

As has been said, Delsarte was a great pioneer in his especial field of work—the art of expression. He made valuable discoveries and continued making them so long as he lived. He was profound and progressive in his art. Without Delsarte the evolution of expression would not be where it is to-day.

There are, however, certain limitations which stand in the way of his philosophy as

a working force, and they have been a fruitful source of criticism, both just and unjust, intelligent and ignorant. The endeavor will be briefly to point out these limitations. Once understood, the remedies suggest themselves and the thoughtful student sees all the more clearly how grand and philosophical a foundation this master laid for his art, which needed only time and its concomitant work and progress to develop.

You Must Exercise Your Will.

As a first limitation, Delsarte made no provision in his psychology for the human will. It is needless to state to the intelligent student or teacher that any system of education in any art or science whatsoever that does not provide a method which shall exercise and develop all the mental attributes in their natural order and action, has a most vital and fatal error in it, which will be shown irrevocably in the results produced.

The will is the "chief corner-stone in every sound form of psychology," and to disregard it as a mental force is to ignore that which makes man what he is.

Delsarte rested his psychology upon a trinity. Psychology in its most modern and progressive stages recognizes a fraternity: consciousness or life, affection, will, intellect. Omit one of these and the result cannot but be wrong.

Again, Delsarte made no provision for the relations and responsive action of groups of muscles. By the very law of opposition in the human body, certain groups of muscles act in response to other groups of muscles. The parts of the body are not isolated and independent. There is absolute unity in this most perfect of all architectures.

Because of this non-provision, a system of physical culture based rigidly and absolutely on his principles, could not be a satisfactory system. It would fail to provide for and cultivate one of the most vital necessities of the human body—the interaction of all the muscles. There would be obvious lack of unity and hence lack of grace in a body so cultivated.

And this involves a further omission—he made no provision for reflex action in the human body, which is the secret spring of all natural gesture. It seems incomprehensible that so keen and thoughtful a student as Delsarte should fail to take cognizance of the fact that the muscles react from muscular sense. However, in his time this sixth sense was not recognized and understood as it is to-day.

Spontaneous Action.

Not to understand this, paved the way to slip into another error all the more easily. Delsarte leaves out *spontaneity*. It can be seen, of course, that it is implied in his philosophy, but it is not definitely recognized and provided for. Right here is the vital flaw which justly calls forth the criticism that Delsarte's method implicitly followed disappoints in developing the orator and the actor, in that it makes them mechanical.

His ideas are absolutely correct, proven by common observation, but some of his methods of producing results to conform to them are not only insufficient but erroneous, because of the non-recognition of all the mental and physical forces and their fundamental principles of action.

"Art rests right upon that law of spontaneity." Nature is spontaneous in action, by means of that secret spring of reflex action.

One of the truest of his followers, commenting upon this very point, has put and answered these most pertinent questions: "How did Delsarte learn his various prin-

ciples were true? How did he learn what gestures mean? By watching what people did when excited by their emotions. What did these spring from? From the spontaneity of the mind." Thus all expression should come from an inward impulse, and where mind and body are in perfect harmony the expression will be exactly suited to the thought and emotion—nothing forced about it, nothing mechanical, but rather the free act of a living being in distinction from a mere machine.

Special Training.

It goes without saying, that both the voice and the ability to express thought and feeling must be developed and cultivated. But it is not so quickly and generally recognized that physical culture is a necessary concomitant of education in expression. Let the mind never so well trained, profound and agile in thought, if the body, its medium of manifestation, be uncultivated, muscles stiff or inert, and unable to respond quickly and intelligently to the mental impulses, the result must be awkwardness, weakness, and inaccuracy of gesture.

Cultivate the muscles, rendering the whole physique in every part pliable and quick to respond to the emotions, and there will be naturally the conformity to the laws which Delsarte primarily deduced from nature. That a student may effectively render a selection, it is not necessary that he should carefully and mechanically formulate what emotions are appropriate to the thoughts expressed in it, and then select and learn the gestures appropriate to such states of mind.

Let him work upon the selection, calling upon the imagination until he can live those scenes and have those states of mind described, and the body will respond. The all-wise Creator took care that the body should not wander through the world without a motive power and controller. Nature takes care of these things if mind and body are normal and free to respond.

The formula is simple: "Objects appeal to the mind, the mind acts, the body expresses."

Does this need proof? "Give a dog something he wants; some secret spring will move his eyes and wriggle his tail just right." It will not be necessary to look up the proper rules first and then instruct him to place and move his parts to correspond. Children act naturally, and their actions are spontaneous. They have no rules for expression, yet in the main no expression is more effective. They are natural in all things.

Talking with the Body.

Gesture is the delineation in the air, by the physical agents of the body, of mental conceptions. "The basis of oratory is to get the body to respond to the thought." In every act of the human being we have to recognize the close and subtle relation of body and soul. The mind is the divine in man, the only source of instruction to the body.

"Gesture is in the soul." "Man is a stream whose source is hidden," says the philosopher, Ralph Waldo Emerson; "always our being is descending into us from we know not whence." The human body is given, as shown in its very construction, to be the instrumentality of expression to the soul it incarnates. It has not been limited to one way of expression. It has been richly gifted in this as in other things. One way is gesture.

Gesture was, undoubtedly, man's first and only language. Gesture includes more than the movements of the hands and arms, or

the body as a whole. It necessarily includes all the physical agents, all parts of the body, the most subtle of all being the eye and mouth. In reference to the mouth, this does not mean its action in speech. There is a subtle movement of the mouth accompanying both speech and silence that is most significant.

Culture of the Body

NOW, how can we cultivate this responsive power of the body to enable the body to be a more ready, more transparent medium for the mind? Obviously, the first essential condition is a healthy body, and physical culture aids in effecting this as powerfully as in rendering the muscles elastic. Exercising any groups of muscles impels, physiologically, to the instinctive adjustment of all the muscles to effect unity with the group exercised.

For example, exercise the muscles of the hand, put the hand in a certain attitude; the whole body, if it be in a normal, pliable condition, will feel constrained, uncomfortable, unless it is permitted to adjust itself in an attitude agreeing with that of the hand. If the body be allowed to assume, in all its parts, the corresponding attitude, there is a comfortable muscular feeling. This instinctive feeling in the muscles is muscular sense, and very good common sense it is, too.

To sum up, in a few words, the trend of these statements concerning gesture is only to say to the sincere student, let nature work in her own divine way. Cultivate the mind to comprehend, the body to respond, and your gestures will take care of themselves, as have always the gestures of every God-inspired orator and reader.

Yet, to have some practical instruction, based on the principles already stated, will aid the young student.

Delsarte taught his criteria of gesture of the hand with a cube. Holding the hand out straight, palm up, so that the cube can rest on it, signifies upholding, sustaining. Delsarte adds, "giving," "receiving;" but it will be observed the action of the hand is the same for both. The hand passed to the side gives the position of separation, which Delsarte calls "definition." If the hand be raised to attract attention, the forefinger will be inclined to act, thus separating the person desired from others. The hand passed to the top of the cube covers it, protects; thus held flat, signifies protection; curved, implies something more tender—a caress.

Use of the Hand.

The same gesture is a true one when describing certain actions, as of animals running—they cover so much ground. The term "cover" is considered by one of our own great teachers a more generic term than "protect." The hand passed to the opposite side gives the attitude of rejection, a familiar gesture. The hand passed to the outer end, palm toward the cube, signifies limitation; passed to the end next the person, back of hand to cube, fingers pointing up, signifies revelation. The palm may mean repulsion or attraction, depending on the sentiment.

A person of great responsiveness is apt to use both hands and also both arms. The whole personality is interested. In merely mental activity—reasoning—one hand, one finger will be employed.

"The "perpendicular" movements of the arm are those of appellation, salutation, affirmation. The "lateral" movements are those of declaration, negation, rejection. The "forward" movements are those of repulsion, attraction, supplication.

The altitude of gesture depends somewhat on the position of the object of thought. The hand will move in curves—nature's own lines. All gestures are affected by the altitude which indicates the moral plane. Greater intellectuality gives higher gestures. The more vividly the imagination works, rendering the thought brilliant, the higher the gestures. Tendencies of character will modify the gestures. A great and profound teacher sums up the matter thus: "The rounded, the complete individual is one whose gestures, like the singer's voice, play up and down the scale.

It must be remembered that we have spoken of the gestures of only one agent, the hand. The nobler and subtler gestures are of the face and chest. The eye has a language of its own; it is a wonderful agent of expression. Look your thought; speak it with your eyes. All the features of your face were made to talk. Let your face speak all emotions—surprise, joy, fear, hope, expectancy, anguish, in short, every mood of the inner being. Feel the emotions; make them your own, and then express them naturally.

Exercises for the Body.

1. With body erect and hands at sides, move the head to right and left, and forward and backward; cultivates the muscles of the neck.

2. With hands on the hips, move the upper part of the body to right and left, and forward and backward; this cultivates the muscles of the chest and back.

3. Close the hands, extend the arms in front, and bring the hands together behind the back; repeat at least twenty times.

4. Stand erect, with arms straight at the sides; move the arms outward from the sides, and elevate them, bringing the hands above the head; repeat at least twenty times.

5. Hold the right arm out horizontally, palm of hand upward; double the left arm, the tips of the fingers resting on the shoulder; then stretch out the left arm, at the same time doubling the right arm and placing the tips of the fingers on the right shoulder; repeat, and then make the movements with both arms simultaneously.

Hands and Arms.

6. Holding the arms straight, swing them with a rotary motion, thrusting them forward as they are elevated and backward as they are lowered, bringing them to the sides, and then repeat.

7. Lift the hands from the sides to the shoulders, then raise the arms at full length above the head, and also extend them horizontally, dropping them at the sides; repeat.

8. Standing erect, with the hands on the hips, lower the body, bending the knees, the weight resting on the toes, and rise; repeat at least fifteen times, but not too fast.

9. Placing the hands on the hips, right leg forward and left leg slightly bent; thrust the body forward, thus straightening the left leg and bending the right; then placing the left leg forward, repeat movements.

10. With the body bent forward, closed hands between the knees, raise the body and elevate the hands above the head, taking care to keep the arms straight; repeat.

11. Place the hands on the front side of the hips, bend the body forward, and then rise to an erect position, at the same time throwing the head backward; repeat.

12. Steady yourself with one hand on a chair; place the other hand on the hip and swing the leg forward across the other; then backward; repeat, and then swing the other leg in like manner.

13. Steady yourself with one hand on a chair, place the other hand on the hip, and swing the leg forward and backward; repeat, and then swing the other leg in like manner.

Free Gymnastics.

14. Stretch the body forward, placing the hands on the bottom of a chair; then straighten the arms and raise the body. This must not be repeated so many times as to render the muscles sore and stiff.

15. Extend the arms forward at full length, palms downward; then move the hands backward and forward as far as possible; this renders the fingers and muscles of the wrist pliant.

16. Stand erect with hands on the hips and light weight on the head; then rise on the toes and fall.

17. Extend the arms slightly from the sides, close the hands and then rotate them; this cultivates the muscles of the arms.

18. With body erect and hands on the hips, fill the lungs to their utmost capacity; then slowly emit the breath. Fill the lungs again, and emit more rapidly; again, and emit with a quick, explosive force.

The parts primarily and directly concerned in the production of the human voice in speech and song are the articulating organs and chambers of resonance, the vocal cords, the lungs, and the muscles of respiration. We cannot, however, separate the voice from any of the vital parts.

The prime physical aid to the cultivation of the voice is a healthy body. All the vocal organs should respond quickly and easily to mind and will, to the thought and emotion, and the mental effort employed in expressing them.

The reader must always remember that his work is distinctly and wholly for others. Keep ever in mind that you read your selection to please, to instruct, to inspire your fellow-beings, and not to exhibit yourself and your powers; then there will be no danger of self-consciousness.

Then be thoroughly and entirely alive. No perfection of manner can atone for lack of life. Again, although there is no human device by which to measure it, time is necessary for the transmission of thought. It takes time for your voice to reach the physical ear of the listener, then time for the thought to reach his consciousness and produce its effect. Give time for the thought to implant itself. In addition to this, there is no more suggestive emphasis than a pause.

You Must Think on Your Feet.

Take care not to do all your thinking beforehand; cultivate the power to think on your feet, at the time you are speaking, otherwise your reading will indeed be a recitation—a mere mechanical recapitulation of past thinking—and it will lack the fire of the soul's present action, which alone touches and inflames the hearts of others. A selection just committed, on the other hand, without having had time to be well-grounded and analyzed, will be given in a mass—all alike.

Talk with your audience, not at them or over their heads. Cultivate a conversational style. It has been said of one of the greatest of our orators—Wendell Phillips—that his oratory was that of "a gentleman talking."

Remember, the greatest thing you bring to an audience is your own personality. Would you succeed in your art, cultivate all that goes to make up the great artist—body, heart and soul.

HOW TO REMEMBER

The Loisette Memory System

WHATEVER will aid the memory, render it more quick and retentive, enable it to lay hold of facts, figures and circumstances, and store them away, only to be instantly brought forth when required, cannot fail to be of great value to every individual. So much has been said about Loisette's memory system, the art has been so widely advertised, and so carefully guarded from all the profane who do not send five or many dollars to the professor, that a few pages showing how every man may be his own Loisette may be both interesting and valuable.

In the first place, the system is a good one, and well worth the labor of mastering, and if the directions are implicitly followed there can no doubt that the memory will be greatly strengthened and improved, and that mnemonic feats otherwise impossible may be easily performed.

Loisette, however, is not an inventor, but an introducer. He stands in the same relation to Dr. Pick that the retail dealer holds to the manufacturer: the one produced the article; the other brings it to the public. Even this statement is not quite fair to Loisette, for he has brought much practical common sense to bear upon Pick's system, and, in preparing the new art of mnemonics for the market, in many ways he has made it his own. New and valuable rules and suggestions have been added.

If each man would reflect upon the method by which he himself remembers things, he would find his hand upon the key of the whole mystery. For instance, the author was once trying to remember the word *blythe*. There occurred to my mind the words "bellman," "belle," and then the verse:

> "———the peasant upward climbing
> Hears the bells of *Buloss* chiming,"

"Barcarole," "barrack," and so on until finally the word "blythe" presented itself with a strange insistence, long after I had ceased trying to recall it.

On another occasion, when trying to recall the name "Richardson," I got the words "hayrick," "Robertson," "Randallstown," and finally "wealthy," from which, naturally, I got "rich" and "Richardson" almost in a breath.

Still another example: trying to recall the name of an old schoolmate, "Grady," I got "Brady," "grave," "gaseous," "gastronome," "gracious," and I finally abandoned the attempt, simply saying to myself that it began with a "G," and there was an "a" sound after it. The next morning, when thinking of something entirely different, the name "Grady" came up in my mind with as much distinctness as though some one had whispered it in my ear.

Words of Similar Sounds.

This remembering was done without any conscious effort on my part, and was evidently the result of the exertion made the day before when the mnemonic processes were put to work. Every reader must have had a similar experience which he can recall, and which will fall in line with the examples given.

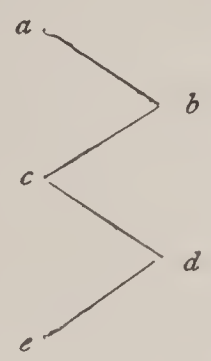
It follows, then, that when we endeavor, without the aid of any system, to recall a forgotten fact or name, our memory presents to us words of similar sound or meaning in its journey toward the goal to which we have started it. This goes to show that our ideas are arranged in groups in whatever secret cavity or recess of the brain they occupy, and that the arrangement is one not alphabetical exactly, and not entirely by meaning, but after some fashion partaking of both.

If you are looking for the word "meadow," you may reach "middle" before you come to it, or "Mexico," or many words beginning with the "m" sound, or containing the "dow," as "window" or "dough," or you may get "field" or "farm"—but you are on the right track, and if you do not interfere with your intellectual process you will finally come to the idea which you are seeking.

How often have you heard people say, "I forget his name; it is something like Beadle or Beagle—at any rate it begins with a B." Each and all of these were unconscious Loisettians, and they were practicing blindly, and without proper method or direction, the excellent system which he teaches. The thing, then, to do—and it is the final and simple truth which Loisette teaches—is to travel over this ground in the other direction—to cement the fact you wish to remember to some other fact or word which you know will be brought out by the implied conditions—and thus you will always be able to travel from your given starting-point to the thing which you wish to call to mind.

How the Mind Works.

To illustrate: let the broken line in the annexed diagram represent a train of thought. If we connect the idea "*a*" with "*e*" through the steps *b*, *c* and *d*, the tendency of the mind ever afterwards will be to get to *e* from *a* that way, or from any of the intermediates that way. It seems as though a channel were cut in our mind-stuff along which the memory flows. How to make it flow this way will be seen later on. Loisette, in common with all mnemonic teachers, uses the old device of representing numbers by letters—and as this is the first and easiest step in the art, this seems to be the most logical place to introduce the accepted equivalents of the Arabic numerals.



0 is always represented by *s*, *z* or *c* soft.
1 is always represented by *t*, *th* or *d*.
2 is always represented by *n*.
3 is always represented by *m*.
4 is always represented by *r*.
5 is always represented by *l*.
6 is always represented by *sh*, *j*, *ch* soft or *g* soft.
7 is always represented by *g* hard, *k*, *c* hard, *q* or final *ng*.
8 is always represented by *f* or *v*.
9 is always represented by *p* or *b*

All the other letters are simply to fill up. Double letters in a word count only as one. In fact, the system goes by sound, not by spelling—for instance, "this" or "dizzy" would stand for *ten;* "catch" or "gush" would stand for 76, and the only difficulty is to make some word or phrase which will contain only the significant letters in the proper order, filled out with non-significants in some guise of meaning or intelligibility. You can remember the equivalents by noting the fact that *z* is the first letter of "zero," and *c* of "cipher," *t* has but one stroke, *n* has two, *m* three. The script *f* is very like 8, the script *p* like 9; *r* is the last letter of *four*, *l* is the Roman numeral for fifty, which suggests *five*. The others may be retained by memorizing these two nonsense lines:

Six *sh*y *J*ewesses *ch*ase *G*eorge.
Seven *g*reat *k*ings came *q*uarreling.

Suppose you wished to get some phrase or word that would express the number 3,685, you arrange the letters this way:

	3	⌒	6	⌒	8	⌒	5
a	m	a	sh	a	f	a	l
e		e	j	e	v	e	
i		i	ch	i		i	
o		o	g	o		o	
u		u		u		u	
h		h		h		h	
w		w		w		w	
x		x		x		x	
y		y		y		y	

You can make out "image of law," "my shuffle," "matchville," etc., etc., as far as you like to work it out.

Now, suppose that you wished to memorize the fact that $1,000,000 in gold weighs 3,685 pounds, you go about it in this way, and here is the kernel and crux of Loisette's system:

"How much does $1,000,000 in gold weigh?"

"Weigh—scales."

"Scales—statue of Justice."

"Statue of Justice—*image of law.*"

The process is simplicity itself. The thing you wish to recall, and that you fear to forget, is the weight; consequently you cement your chain of suggestion to the idea which is most prominent in your mental question. What do you weigh with? Scales. What does the mental picture of scales suggest? The statue of Justice, blindfolded and weighing out award and punishment to man. Finally, what is the statue of Justice but the image of law? and the words "image of law," translated back from the significant letters *m*, *g* soft, *f* and *l*, give you 3–6–8–5, the number of pounds in $1,000,000 in gold. The process is plain and simple.

Firmly Fixed.

You bind together in your mind each separate step in the journey, the one suggests the other, and you will find a year from now that the fact will be as fresh in your memory as it is to-day. You cannot lose it. It is chained to you by an unbreakable mnemonic tie. Mark, that it is not claimed that "weight" will of itself suggest "scales," and "scales," "statue of Justice," etc., but that, having once passed your attention up and down that ladder of ideas, your mental tendency will be to take the same route, and get to the same goal again and again. Indeed, beginning with the weight of $1,000,000, "image of law" will turn up in your mind without your consciousness of any intermediate station on the way, after some iteration and reiteration of the original chain.

Again, so as to fasten the process in the reader's mind even more firmly, suppose that it were desired to fix the date of the battle

of Hastings (A. D. 1066) in the memory; 1066 may be represented by the words "the wise judge" ($th = 1$, $s = 0$, $j = 6$, $dg = 6$; the others are non-significants); a chain might be made thus:

Battle of Hastings—arbitrament of war.
Arbitrament of war—arbitration.
Arbitration—judgment.
Judgment—the wise judge.

Make mental pictures, connect ideas, repeat words and sounds, go about it any way you please, so that you will form a mental habit of connecting the "battle of Hastings" with the idea of "arbitrament of war," and so on for the other links in the chain, and the work is done.

One Idea Suggests Another.

Loisette makes the beginning of his system unnecessarily difficult, to say nothing of his illogical arrangement in the grammar of the art of memory, which he makes the first of his lessons. He analyzes suggestion into—

1. Inclusion.
2. Exclusion.
3. Concurrence.

All of which looks scientific and orderly, but is really misleading, and badly named. The truth is that one idea will suggest another:

1. By likeness or opposition of meaning, as "house" suggests "room" or "door," etc.; or, "white" suggests "black;" "cruel," "kind," etc.

2. By likeness of sound, as "harrow" and "barrow;" "Henry" and "Hennepin."

3. By mental juxtaposition, a peculiarity different in each person, and depending upon each one's own experience. Thus, "St. Charles" suggests "railway bridge" to me, because I was vividly impressed by the breaking of the Wabash bridge at that point. "Stable" and "broken leg" come near each other in my experience, so do "cow" and "shot-gun" and "licking."

Out of these three sorts of suggestions, it is possible to get from any one fact to any other in a chain certain and safe, along which the mind may be depended upon afterwards always to follow.

Necessity of Attention.

The chain is, of course, by no means all. Its making and its binding must be accompanied by a vivid, methodically directed attention, which turns all the mental light gettable in a focus upon the subject passing across the mind's screen. Before Loisette was thought of this was known. In the old times in England, in order to impress upon the mind of the rising generation the parish boundaries in the rural districts, the boys were taken to each of the landmarks in succession, the position and bearing of each pointed out carefully, and, in order to deepen the impression, the young people were then and there vigorously thrashed, a mechanical method of attracting attention, which was said never to have failed.

This system has had its supporters in many of the old-fashioned schools, and there are men who will read these lines who can recall with an itching sense of vivid expression the 144 lickings which were said to go with the multiplication table.

In default of a thrashing, however, the student must cultivate as best he can an intense fixity of perception upon every fact or word or date that he wishes to make permanently his own. It is easy. It is a matter of habit. If you will you can photograph an idea upon your cerebral gelatine so that neither years nor events will blot it out or overlay it.

You must be clearly and distinctly aware

of the thing you are putting into your mental treasure-house, and drastically certain of the cord by which you have tied it to some other thing of which you are sure. Unless it is worth your while to do this, you might as well abandon any hope of mnemonic improvement, which will not come without the hardest kind of hard work, although it is work that will grow constantly easier with practice and reiteration.

You need, then :

1. Methodic suggestion.
2. Methodic attention.
3. Methodic reiteration.

And this is all there is to Loisette, and a great deal it is. Two of them will not do without the third. You do not know how many steps there are from your hall-door to your bed-room, although you have attended to and often reiterated the journey. But if there are twenty of them, and you have once bound the word "nice," or "nose," or "news," or "hyenas," to the fact of the stairway, you could never forget it.

The Mental Discipline.

The Professor makes a point, and very wisely, of the importance of working through some established chain, so that the whole may be carried away in the mind—not alone for the value of the facts so bound together, but for the mental discipline so afforded.

Here, then, is the "President Series," which contains the name and date of inauguration of each president from Washington to Cleveland. The manner in which it is to be mastered is this : Beginning at the top, try to find in your mind some connection between each word and the one following it. See how you can, at some future time, make one suggest the next, either by suggestion of sound or sense, or by mental juxtaposition. When you have found this, dwell on it attentively for a moment or two. Pass it backward and forward before you, and then go on to the next step.

The chain runs thus, the names of the presidents being in small caps, the date words in italics :

President.....Chosen as the first word as the one most apt to occur to the mind of any one wishing to repeat the names of the presidents.
Dentist.....Pres*ident* and *dent*ist.
Draw.....What does a dentist do?
To give up.....When something is drawn from one it is given up. This is a date phrase meaning 1789.
Self-sacrifice.....There is an association of thought between giving up and self-sacrifice.
WASHINGTON .....Associate the quality of self-sacrifice with Washington's character.
Morning wash.....*Wash*ington and *wash*.
Dew.....Early wetness and dew.
Flower beds.....Dew and flowers.
Took a bouquet.....Flowers and bouquet. Date phrase (1797).
Garden.....Bouquet and garden.
Eden.....The first garden.
Adam.....Juxtaposition of thought.
ADAMS.....Suggestion by sound.
Fall.....Juxtaposition of thought.
Failure.....Fall and failure.
Deficit.....Upon a failure there is usually a deficit. Date word (1801).
Debt.....The consequence of a deficit.
Bonds.....Debt and bonds.
Confederate bonds.Suggestion by meaning.
Jefferson Davis.....Juxtaposition of thought.
JEFFERSON.

Now follow out the rest for yourself, taking about ten at a time, and binding those you do last to those you have done before, each time, before attacking the next bunch.

1	2	3
JEFFERSON	*tough make*	*Theophilus*
Judge Jeffreys	oaken furniture	fill us
bloody assize	bureau	FILLMORE
bereavement	VAN BUREN	more fuel
too heavy a sob	rent	*the flame*

parental grief	side-splitting	flambeau
mad son	*divert*	bow
MADISON	annoy	arrow
Madeira	harassing	PIERCE
first-rate wine	HARRISON	hurt
frustrating	Old Harry	*feeling*
defeating	the tempter	wound
feet	*the fraud*	soldier
toe the line	painted clay	cannon
row	baked clay	BUCHANAN
MONROE	tiles	rebuke
row	TYLER	official censure
boat	Wat Tyler	*to officiate*
steamer	poll tax	wedding
the funnel	compulsory	linked
windpipe	*free will*	LINCOLN
throat	free offering	link
quinzy	burnt offering	stroll
QUINCY ADAMS	poker	sea shore
quince	POLK	*the heavy shell*
fine fruit	end of dance	mollusk
the fine boy	termination 'ly'	unfamiliar word
sailor boy	*adverb*	dictionary
sailor	part of speech	Johnson's
jack tar	part of a man	JOHNSON
JACKSON	TAYLOR	son
stone wall	measurer	bad son
indomitable	theodolite	dishonest boy
thievish boy	hazy	well fed
take	clear	well read
give	*vivid*	author
GRANT	brightly lighted	ARTHUR
award	camp fire	round table
school premium	war field	tea table
examination	GARFIELD	tea cup
cramming	Guiteau	*half full*
fagging	murderer	divide
laborer	prisoner	cleave
hay field	prison fare	CLEVELAND
HAYES	*half fed*	

It will be noted that some of the date words, as "free will," only give three figures of the date, 845; but it is to be supposed that if the student knows that many figures in the date of Polk's inauguration he can guess the other one.

The curious thing about this system will now become apparent. If the reader has learned the series so that he can say it down from President to Cleveland, he can with no effort, and without any further preparation, say it *backward* from Cleveland up to the commencement! There could be no better proof that this is the natural mnemonic system. It proves itself by its works.

The series should be repeated backwards and forwards every day for a month, and should be supplemented by a series of the reader's own making, and by this one, which gives the numbers from 0 to 100, and which must be chained together before they can be learned:

0—hoes

1 wheat	34 mare	67 jockey
2 hen	35 mill	68 shave
3 home	36 image	69 ship
4 hair	37 mug	70 eggs
5 oil	38 muff	71 gate
6 shoe	39 mob	72 gun
7 hook	40 race	73 comb
8 off	41 hart	74 hawker
9 bee	42 horn	75 coal
10 daisy	43 army	76 cage
11 tooth	44 warrior	77 cake
12 dine	45 royal	78 coffee
13 time	46 arch	79 cube
14 tower	47 rock	80 vase
15 dell	48 wharf	81 feet
16 ditch	49 rope	82 vein
17 duck	50 wheels	83 fame
18 dove	51 lad	84 fire
19 tabby	52 lion	85 vial
20 hyenas	53 lamb	86 fish
21 hand	54 lair	87 fig
22 nun	55 lily	88 fife
23 name	56 lodge	89 fib
24 owner	57 lake	90 pies
25 nail	58 leaf	91 putty
26 hinge	59 elbow	92 pane
27 ink	60 chess	93 bomb
28 knife	61 cheat	94 bier
29 knob	62 chain	95 bell
30 muse	63 sham	96 peach
31 mayday	64 chair	97 book
32 hymen	65 jail	98 beef
33 mama	66 judge	99 pope

100—diocese

By the use of this table, which should be committed as thoroughly as the President series, so that it can be repeated backwards and forwards, any date, figure or number can be at once constructed, and bound by

the usual chain to the fact which you wish it to accompany.

When the student wishes to go farther and attack larger problems than the simple binding of two facts together, there is little in Loisette's system that is new, although there is much that is good. If it is a book that is to be learned as one would prepare for an examination, each chapter is to be considered separately.

Make a Synopsis.

Of each a *precis* is to be written in which the writer must exercise all his ingenuity to reduce the matter in hand to its final skeleton of fact. This he is to commit to memory, both by the use of the chain and the old system of interrogation. Suppose after much labor through a wide space one boils a chapter or an event down to the final irreducible sediment: "Magna Charta was exacted by the barons from King John at Runnymede."

You must now turn this statement this way and that way, asking yourself about it every possible and impossible question, gravely considering the answers, and, if you find any part of it especially difficult to remember, chaining it to the question which will bring it out. Thus, "What was exacted by the barons from King John at Runnymede?" "Magna Charta." "By whom was Magna Charta exacted from King John at Runnymede?" "By the barons." "From whom was," etc., etc.? "King John." "From what king," etc., etc.? "King John." "Where was Magna Charta," etc., etc.? "At Runnymede."

And so on and so on, as long as your ingenuity can suggest questions to ask, or points of view from which to consider the statement. Your mind will be finally saturated with the information, and prepared to spill it out at the first squeeze of the examiner. This, however, is not new. It was taught in the schools hundreds of years before Loisette was born. Old newspaper men will recall in connection with it Horace Greeley's statement that the test of a news item was the clear and satisfactory manner in which a report answered the interrogatories, "What?" "When?" "Where?" "Who?" "Why?"

In the same way Loisette advises the learning of poetry. For example:

"The Assyrian came down like a wolf on the fold."

"Who came down?"

"How did the Assyrian come down?"

"Like what animal did?" etc.

And so on and so on, until the verses are exhausted of every scrap of information to be had out of them by the most assiduous cross-examination.

Remembering Figures.

Whatever the reader may think of the availability or value of this part of the system, there are so many easily applicable tests of the worth of much that Loisette has done, that it may be taken with the rest.

Few people, to give an easy example, can remember the ratio between the circumference and the diameter of the circle—beyond four places of decimals, or at most six—3.141592+. Here is the value to 108 decimal places:

3.14159265·3589793238·4626433832·795
0288419·7169399375·1058209749·445
9230781·6406286208·998620348·2534
211706·7982148086+

By a very simple application of the numerical values these 108 decimal places can be carried in the mind

SYNONYMS AND ANTONYMS

FOR the purpose of avoiding too much repetition in writing and speaking it is necessary to have a Dictionary of words of similar meaning. A Synonym is one of two or more words of similar significance which may often be used interchangeably. An Antonym is a word of opposite meaning. In the following list the Synonyms are first given; then follow, in parenthesis, the Antonyms, or words of opposite meaning.

All persons who would acquire an elegant style in literary composition, correspondence or ordinary conversation, will find this comprehensive Dictionary of Synonyms and Antonyms of great value. Jewels of thought should be set in appropriate language.

In this Table the letter *a* means adjective; *v* means verb; *n* means noun or substantive.

ABANDON—forsake, desert, renounce, relinquish. (Keep, cherish.)

ABANDONED — deserted, forsaken, profligate, wicked, reprobate, dissolute, flagitious, corrupt, depraved, vicious. (Respected, esteemed, cherished, virtuous.)

ABASEMENT—degradation, fall, degeneracy, humiliation, abjectness, debasement, servility. (Elevation, promotion, honor.)

ABASH—disconcert, discompose, confound, confuse, shame, bewilder. (Embolden.)

ABBREVIATE—shorten, curtail, contract, abridge, condense, reduce, compress. (Lengthen, extend, enlarge, expand.)

ABDICATE—renounce, resign, relinquish. (Usurp.)

ABET—incite, stimulate, whet, encourage, back up, second, countenance, assist. (Dampen, discourage, dispirit, depress, repress, oppose.)

ABETTOR—instigator, prompter, assistant, coadjutor, accomplice, accessory, *particeps criminis*. (Extinguisher.)

ABHOR—loathe, abominate, (Love, admire.)

ABILITY—power, skill, gumption, efficiency, mastery, qualification, faculty, expertness. (Incompetence, inefficiency, inability.)

ABJECT—despised, despicable, vile, grovelling, mean, base, worthless, servile. (Supreme, august, commanding, noble.)

ABJURE—forswear, disclaim, unsay, recant, revoke, deny, disown. (Attest, affirm.)

ABLE—competent, qualified, skilled, efficient, capable, clever, adroit, adept, strong, telling, masterly. (Incompetent, weak, unskilful, unqualified.)

ABODE—dwelling, residence, domicile, home, quarters, habitation, lodging, settlement. (Transition, shifting, wandering, pilgrimage, peregrination.)

ABOLISH—efface, extinguish, annihilate, nullify, destroy, undo, quash, annul, cancel, abrogate, quench, suppress, vitiate, revoke. (Introduce, establish, enforce, restore.)

ABOMINABLE—detestable, hateful, odious, execrable. (Choice, excellent, attractive, select.)

ABORTIVE—ineffectual, futile, inoperative, defective, inadequate. (Efficient, productive, complete.)

ABOUT—around, near to, nearly, approximately, contiguous. (Remote from, distant.)

ABSCOND—take oneself off, "vamoose," disappear, decamp, run away. (Thrust oneself into notice.)

ABSENT—not present, wanting, absentminded, abstracted, inattentive, listless, dreamy, visionary. (Present, collected, composed, vigilant, observant.)

ABSOLUTE—certain, unconditioned, unconditional, unlimited, unrestricted, transcendent, authoritative, paramount, imperative, arbitrary, despotic. (Conditional, limited, hampered, fettered.)

ABSORB—suck up, imbibe, engross, drain away, consume. (Reserve, save, spare, husband, economize, hoard up.)

ABSURD—unreasonable, nonsensical, foolish, vain, impracticable. (Reasonable, prudent, veracious.)

ABUSE, *v.*—pervert, deprave, traduce, debase, disparage, slander, calumniate, rail at, reproach, depreciate. (Improve, develop, cultivate, promote, bless, magnify, appreciate.)

ABUSE, *n.*—perversion, ill-usage, depravation, debasement, slander, reproach. (Cultivation, use, promotion, development, appreciation, praise.)

ACCEDE—join, assent, acquiesce in, comply, agree, concur, coincide, approve. (Dissent, object, decline, refuse.)

ACCELERATE—hasten, hurry, speed, expedite, quicken, precipitate, facilitate. (Retard, delay, procrastinate, arrest, stop, impede, suspend.)

ACCEPT—take, receive, assume, acknowledge, endorse. (Refuse, repudiate, protest, disown.)

ACCEPTABLE—pleasant, grateful, welcome. (Repugnant, displeasing.)

ACCIDENT—casualty, contingency, hap, mishap, chance, mischance, misadventure. (Law, order.)

ACCOMMODATE—adjust, adapt, fit, conform, reconcile, suit, oblige, furnish, convenience. (Cross, thwart, counteract, plot against, checkmate, defeat, inconvenience.)

ACCOMPLICE—confederate, ally, associate, accessory, *particeps criminis*. (Adversary, rival, spy, opponent, enemy.)

ACCOMPLISH—complete, perform, finish, fulfil, execute, perfect, consummate, achieve, effect, carry out. (Fail, miscarry, undo, wreck, frustrate.)

ACCOMPLISHMENT—success, fulfilment, completion, performance, execution, achievement, consummation, attainment. (Failure, miscarriage, wreck, ruin.)

ACCORD—harmonize, agree, allow, grant, concede. (Jar, clash with, deny, disallow.)

ACCOST—address, confront, speak to, greet, salute. (Evade, fight shy of.)

ACCOUNT, *v.*—compute, estimate, reckon up, take stock of. (Leave unexplained, unsolved.)

ACCOUNT, *n.*—reckoning, relation, charge, bill. (Riddle, mystery, puzzle, unknown quantity.)

ACCOUNTABLE—answerable, responsible, amenable. (Exempt, free, irresponsible.)

ACCUMULATE—heap up, save, collect. (Scatter, dissipate, diffuse, spend, squander.)

ACCUMULATION—heap, amount, glut, (Dissipation, dissemination, distribution, diminution.)

ACCURATE—definite, precise, correct, exact. (Inaccurate, wrong, erroneous, blundering, careless.)

ACHIEVE—complete, gain, win.

ACHIEVEMENT—feat, exploit, distinguished performance, acquirement. (Abortion, frustration, failure, shortcoming, defect.)

ACKNOWLEDGE—avow, confess, own, recognize, admit, grant, concede. (Repudiate, disclaim, disallow, disown, deny.

ACQUAINT—make known, apprise, inform, communicate, intimate, notify. (Leave ignorant, keep secret, conceal.)

ACQUAINTANCE—knowledge, familiarity, fellowship, companionship. (Ignorance, stranger.)

ACQUIESCE—yield, concur, agree, assent. (Protest, object, dissent, secede, oppose.)

ACQUIT—set free, release, discharge, clear, absolve, exculpate, exonerate, liberate, deliver. (Accuse, impeach, charge, blame, convict.)

ACT, *v.*—do, perform, commit, operate, work, practice, behave, personate, play, enact. (Neglect, cease, desist, rest, wait, lie idle, refrain.)

ACTION—working, agency, operation, business, gesture, engagement, fight, deed, battle, feat. (Inaction, repose, rest, idleness, ease, indolence, inertia, passiveness, quiescence, dormancy.)

ACTIVE—energetic, busy, stirring, alive, brisk, operative, lively, agile, nimble, diligent, sprightly, alert, quick, supple, prompt, industrious. (Passive, inert, dead, extinct, dull, torpid, sluggish, indolent, lazy, dormant, quiescent, asleep.)

ACTUAL—real, positive, existing, certain. (False, imaginary, theoretical, illusive, fictitious.)

ACUTE—sharp, pointed, penetrating, piercing, keen, poignant, pungent, intense, violent, shrill, sensitive, sharp-witted, shrewd, discriminating, clever, cunning. (Obtuse, blunt, bluff, dull, flat, callous, stupid, apathetic.)

ADAPT—fit, suit, adjust, conform, regulate. (Misfit, discommode, dislocate.)

ADDICTED—committed to, devoted, prone, given up to, inclined, habituated. (Uncommitted, free, uncompromised, neutral.)

ADDITION—annexation, accession, supplement, adjunct, affix, appendage, accessory, increment, increase, complement, *plus*, more. (Abstraction, deduction, retrenchment, curtailment, deprivation, *minus*, less, loss, impoverishment.)

ADDRESS—speech, salutation, accost, appeal; also skill, dexterity, adroitness; also direction, name; also residence. (Response, answer, reply, rejoinder; also awkwardness, maladroitness, clumsiness, slovenliness.)

ADHESION—sticking, adherence, adoption, attachment, espousal. (Repulsion, revulsion, antipathy, aversion, hostility, incompatibility, dislike.)

ADJACENT—next, near, nigh, at hand, alongside, close by, adjoining, contiguous, bordering, neighboring, proximate. (Remote, foreign, distant, aloof, far, apart, asunder.)

ADJOURN—put off, postpone, defer, delay, keep in abeyance, prorogue, suspend, procrastinate, retard, waive, remand, reserve. (Conclude, clinch, accelerate, precipitate.)

ADJUNCT—appendage, affix, annex, annexation, appendix, adhesion, appurtenance. (Curtailment, retrenchment, lop, mutilation, reduction, clipping, docking, filching.)

ADJUST—make exact, set right, fit, adapt, dovetail, arrange, harmonize, settle, regulate. (Confound, confuse muddle, disorder, perplex, embarrass, entangle, clash, jar, jumble, disarrange, unsettle.)

ADMIRABLE—wonderful, excellent, choice, noble, grand, estimable, lovely, ideal, surpassing, extraordinary, eminent. (Detestable, vile, mean, contemptible, despicable, worthless, wretched, villainous, pitiful.)

ADMIT—allow, permit, suffer, receive, usher, grant, acknowledge, confess, concede, accept. (Deny, refuse, shut out, forbid, disown, disclaim.)

ADVANTAGEOUS—profitable, serviceable, useful, beneficial, helpful, of value. (Disadvantageous, detrimental, prejudicial, injurious, hurtful, harmful, deleterious, obnoxious, pernicious.)

AFFECTION—bent, inclination, partiality, attraction, impulse, love, desire, passion, fascination; also suffering, disease, morbidness. (Repulsion, revulsion, antipathy, dislike, recoil, aversion, estrangement, indifference, coldness, alienation; also wholeness, soundness, healthiness.)

AFFECTIONATE—loving, kind, fond, doting, tender, amiable, cordial, hearty, good-hearted. (Cold, unloving, unkind, heartless, selfish, crabbed, sour, malign, malicious, malevolent, misanthropic, cynical, ill-natured, cruel, hating.)

AGREEABLE—pleasant, acceptable, grateful, refreshing, genial, pleasing, palatable, sweet, charming, delectable. (Disagreeable, displeasing, unpleasant, ungrateful, harsh, repellent, painful, noxious, plaguy, irritating, annoying, mortifying.)

ALTERNATING—reciprocal, correlative, interchangeable, by turns, *vice versa*. (Monotonous, unchanging, continual.)

AMBASSADOR—messenger, envoy, emissary, legate, nuncio, diplomatist, diplomate, representative, vicegerent, plenipotentiary, minister, agent. (Principal, government, sovereign, power.)

AMEND—improve, correct, better, meliorate, rectify, prune, repair, revise, remedy, reform. (Injure, impair, damage, harm, hurt, mar, mangle, blemish, deteriorate, ruin, spoil.)

ANGER—resentment, animosity, wrath, indignation, pique, umbrage, huff, displeasure, dungeon, irritation, irascibility, choler, ire, hate. (Kindness, benignity, *bonhomie*, good nature.)

APPROPRIATE—assimilate, assume, possess oneself of, take, grab, clutch, collar, snap up, capture, steal. (Relinquish, give up, surrender, yield, resign, forego, renounce, abandon, discard, dismiss.)

ARGUE—reason, discuss, debate, dispute, contend. (Obscure, darken, mystify, mislead, misrepresent, evade, sophisticate.)

ARISE—rise, ascend, mount, climb, soar, spring, emanate, proceed, issue. (Descend, fall, gravitate, drop, slide, settle, decline, sink, dismount, alight.)

ARTFUL—cunning, crafty, skilful, wily, designing, politic, astute, knowing, tricky. (Artless, naïve, natural, simple, plain, ingenuous, frank, sincere, open, candid, guileless, straightforward, direct.)

ARTIFICE—contrivance, stratagem, trick, design, plot, machination, chicanery, knavery, jugglery, guile, jobbery. (Artlessness, candor, openness, simplicity, innocence, ingenuousness.)

ASSOCIATION—partnership, fellowship, solidarity, league, alliance, combination, coalition, federation, junto, cabal. (Opposition, antagonism, conflict, counteraction, resistance, hinderance, counterplot, detachment, individualism.)

ATTACK—assault, charge, onset, onslaught, incursion, inroad, bombardment, cannonade. (Defence, protection, guard, ward, resistance, stand, repulse, rebuff, retreat.)

AUDACITY—boldness, defiance, prowess, intrepidity, mettle, game, pluck, fortitude, rashness, temerity, presumption, foolhardiness, courage, hardihood. (Cowardice, pusillanimity, timidity, meekness, poltroonery, fear, caution, calculation, discretion, prudence.)

AUSTERE—severe, harsh, rigid, stern, rigorous, uncompromising, inflexible, obdurate, exacting, straight-laced, unrelenting. (Lax, loose, slack, remiss, weak, pliant, lenient, mild, indulgent, easy-going, forbearing, forgiving.)

AVARICIOUS—tight-fisted, griping, churlish, parsimonious, stingy, penurious, miserly, niggardly, close, illiberal, ungenerous, covetous, greedy, rapacious. (Prodigal, thriftless, improvident, extravagant, lavish, dissipated, freehanded.)

AVERSION—antipathy, revulsion, repulsion, dislike, recoil, estrangement, alienation, repugnance, disgust, nausea. (Predilection, fancy, fascination, allurement, attraction, magnet.)

AWE—dread, fear, reverence, prostration, admiration, bewilderment. (Familiarty, indifference, heedlessness, unconcern, contempt, mockery.)

AXIOM—maxim, aphorism, apophthegm, adage, motto, *dictum*, theorem, truism, proverb, saw. (Absurdity, paradox.)

BABBLE—splash, gurgle, bubble, purl, ripple, prattle, clack, gabble, clash, jabber, twaddle, prate, chatter, blab. (Silence, hush.)

BAD—depraved, defiled, distorted, corrupt, evil, wicked, wrong, sinful, morbid, foul, peccant, noxious, pernicious, diseased, imperfect, tainted, touched. (Good, whole, sound, healthy, beneficial, salutary, prime, perfect, entire, untouched, unblemished, intact, choice, worthy.)

BAFFLE—thwart, checkmate, defeat, disconcert, confound, block, outwit, traverse, contravene, frustrate, balk, foil. (Aid, assist, succor, further, forward, expedite, sustain, second, reinforce.)

BASE—crude, undeveloped, low, villainous, mean, deteriorated, misbegotten, ill-contrived, ill-constituted. (Noble, exalted, lofty, sublime, excellent, elect, choice, aristocratic, exquisite, capital.)

BEAR—carry, hold, sustain, support, suffer, endure, beget, generate, produce, breed, hatch. (Lean, depend, hang, yield, sterile, unproductive.)

BEASTLY—bestial, animal, brutal, sensual, gross, carnal, lewd. (Human, humane, virtuous, moral, ethical, intellectual, thoughtful, spiritual.)

BEAT—strike, smite, thrash, thwack, thump, pummel, drub, leather, baste, belabor, birch, scourge, defeat, surpass, rout, overthrow. (Protect, defend, soothe.)

BEAUTIFUL—fair, complete, symmetrical, handsome. (Ugly, repulsive, foul.)

BECOMING—suiting, accordant, fit, seemly. (Discrepant, improper, in bad form.)

BEG—beseech, crave, entreat. (Offer, proffer.)

BEHAVIOR—carriage, deportment, conduct.

BENEFICENT—bountiful, generous, liberal. (Sordid, mercenary.)

BENEFIT—good, advantage, service. (Loss, detriment, injury.)

BENEVOLENCE—well-wishing, charity (Malevolence, malice, hate.)

BLAME—censure, reproach. (Approve, honor.)

BLEMISH—flaw, stain, spot, imperfection, defect. (Ornament, decoration, embellishment, adornment, finery, gilding.)

BLIND—dimsighted, ignorant, uninformed. (Sharpsighted, enlightened.)

BLOT—efface, cancel, expunge, erase. (Record.)

BOLD—brave, daring, fearless, intrepid, courageous. (Cowardly, timid, shy, chicken-hearted.)

BORDER—margin, boundary, frontier, confine, fringe, hem, selvedge, valance. (Inclosure, interior, inside.)

BOUND—circumscribe, limit, restrict, confine, enclose; *also* leap, jump, hop, spring, vault, skip. (Enlarge, clear, deliver; *also* plunge, dip, sink.)

BRAVE—dare, defy. (Cave in, show the white feather.)

BREAK—bruise, crush, pound, squeeze, crack, snap, splinter. (Bind, hold together, knit, rivet.)

BREEZE—blow, zephyr. (Stillness, hush, calm.)

BRIGHT—shining, lustrous, radiant. (Dull, dim.)

BRITTLE—frangible, fragile, frail. (Tough.)

BURIAL—interment, sepulture, obsequies. (Exhumation, disinterment.)

BUSINESS—occupation, employment, pursuit, vocation, calling, profession, craft, trade. (Leisure, vacation, play.)

BUSTLE—stir, fuss, ado, flurry. (Quiet, stillness.)

CALAMITY — misfortune, disaster, catastrophe. (Good luck, prosperity.)

CALM—still, motionless, placid, serene, composed. (Stormy, unsettled, restless, agitated, distracted.)

CAPABLE—competent,able,efficient. (Unqualified.)

CAPTIOUS—censorious, cantankerous. (Conciliatory, bland.)

CARE—solicitude, concern. (Negligence, carelessness, *nonchalance.*)

CARESS—fondle, love, pet. (Spurn, disdain.)

CARNAGE—butchery, gore, massacre, slaughter.

CAUSE—origin, source, ground, reason, motive.

CENSURE—reprehend, chide. (Approve.)

CERTAIN—sure, infallible. (Doubtful, dubious.)

CESSATION—discontinuance, stoppage, rest, halt. (Perseverance, persistence, continuance.)

CHANCE—accident, luck. (Intention, purpose.)

'CHANGE—exchange, *bourse*, mart, emporium.

CHANGEABLE—mutable, variable, fickle. (Steadfast, firm.)

CHARACTER—constitution, nature, disposition.

CHARM—fascination, enchantment, witchery, attraction. (Nuisance, mortification, bore, plague.)

CHASTITY—purity, virtue. (Concupiscence.)

CHEAP—inexpensive, worthless. (Dear, costly.)

CHEERFUL—blithe, lightsome, brisk, sprightly. (Melancholy, sombre, morose, gloomy, sad.)

CHIEF—sachem, head, ruler. (Vassal, henchman.)

CIRCUMSTANCE—situation, predicament.

CLASS—division, category, department, order, kind, sort, genus, species, variety

CLEVER—adroit, dexterous, expert, deft, ready, smart. (Awkward, dull, shiftless, clumsy.)

CLOTHED—dressed, arrayed, apparelled. (Disrobed, stripped.)

COARSE—crude, unrefined. (Refined, cultivated.)

COAX—cajole, wheedle, fawn, lure, induce, entice. (Dissuade, indispose, warn, admonish.)

COLD—frigid, chill, inclement. (Hot, glowing.)

COLOR—hue, tint, tinge, tincture, dye, shade, stain. (Pallor, paleness, wanness, blankness, achromatism, discoloration.)

COMBINATION—coalescence, fusion, faction, coalition, league. (Dissolution, rupture, schism.)

COMMAND—empire, rule. (Anarchy, license.)

COMMODITY—goods, effects, merchandise, stock.

COMMON—general, ordinary, mean, base. (Rare, exceptional, unique.

COMPASSION—pity, commiseration, sympathy. (Cruelty, severity.)

COMPEL—force, coerce, oblige, necessitate, make, constrain. (Let alone, tolerate.)

COMPENSATION—amends, atonement, requital. (Withholding.)

COMPENDIUM—abstract, epitome, digest. (Amplification, expansion.)

COMPLAIN—lament, murmur, regret, repine, deplore. (Rejoice, exult, boast, brag, chuckle.)

COMPLY—consent, yield, acquiesce. (Refuse, deny, decline.)

COMPOUND, *a.*—composite, complex, blended. (Simple, elementary.)

COMPREHEND—comprise, contain, embrace, include, enclose, grasp. (Exclude, reject, mistake, eliminate, loss.)

CONCEAL—hide, secrete, cover, screen, shroud, veil, disguise. (Publish, report, divulge.)

CONCEIVE—grasp, apprehend, devise, invent. (Ignorant of.)

CONCLUSION—result, finding. (Undetermined.)

CONDEMN—convict, find guilty, sentence, doom. (Acquit.)

CONDUCT, *v.*—direct, manage, govern. (Follow, obey, submit.)

CONFIRM—corroborate, ratify, endorse, support, uphold. (Weaken, enfeeble, reduce.)

CONFLICT—contend, contest, wrestle, tussle, clash, wrangle. (Harmonize, agree, fraternize, concur.)

CONFUTE—refute, disprove. (Demonstrate.)

CONQUER—defeat, vanquish, overcome. (Fail, be beaten, lose.)

CONSEQUENCE—effect, derivation, result, event, issue. (Cause, origin, source, antecedent.)

CONSIDER—reflect, deliberate. (Forget, ignore.)

CONSISTENT—accordant, concordant, compatible, consonant, congruous, reconcilable, harmonious. (Discordant, discrepant.)

CONSOLE—relieve, soothe, comfort. (Embitter.)

CONSTANCY—continuance, tenacity, stability. (Irresolution, fickleness.)

CONTAMINATE—Pollute, stain, taint, tarnish, blur, smudge, defile. (Cleanse, purify, purge.)

CONTEMN—despise, disdain, scorn. (Esteem, apprecite, admire.)

CONTEMPLATE—survey, scan, observe, intend. (Disregard.)

CONTEMPTIBLE—despicable, paltry, shabby, beggarly, worthless, vile, cheap, trashy. (Estimable.)

CONTEND—fight, wrangle, vie. (Be at peace.)

CONTINUAL—perpetual, endless, ceaseless. (Momentary, transient.)

CONTINUE—remain, persist, endure. (Desist, stay.)

CONTRADICT—deny, gainsay, oppose. (Affirm, assert, declare.)

CORRECT—mend, rectify. (Impair, muddle.)

COST—expense, charge, price, value.

COVETOUSNESS—avarice, cupidity, extortion. (Generosity, liberality.)

COWARDICE — poltroonery, faint - heartedness. (Courage, boldness, intrepidity.)

CRIME—offence, trespass, misdemeanor, felony, transgression. (Innocence, guiltlessness.)

CRIMINAL—culprit, felon, convict. (Paragon.)

CROOKED—twisted, distorted, bent, awry, wry, askew, deformed. (Straight, upright.)

CRUEL—brutal, ferocious, barbarous, blood-thirsty, fiendish. (Kind, benignant, benevolent.)

CULTIVATION—tillage, culture. (Waste.)

CURSORY—fugitive, hurried, perfunctory. (Permanent, thorough.)

CUSTOM—habit, wont, usage, fashion, practice.

DANGER—peril, hazard, jeopardy. (Safety.)

DARK—obscure, sombrous, opaque, unintelligible. (Light, luminous, shining, clear, lucid.)

DEADLY—mortal, fatal, destructive, lethal.

DEAR—costly, precious, high-priced, beloved, darling, pet, favorite. (Cheap, disliked, despised.)

DEATH—decease, demise, dissolution. (Birth, life.)

DECAY, *n.*—decline, consumption, atrophy. (Development, growth.)

DECEIVE—cheat, defraud, cozen, overreach, gull, dupe, swindle, victimize. (Truthfulness.)

DECEIT, *n.*—imposition, fraud, deception. (Veracity, honesty.)

DECIDE—determine, resolve, conclude, settle, adjudicate, arbitrate, terminate. (Hesitate, dilly-dally, shuffle.)

DECIPHER—interpret, explain, construe, unravel. (Mistake, confound.)

DECISION—determination, conclusion, firmness. (Wavering, hesitancy.)

DECLAMATION — harangue, oration, recitation, tirade, speech.

DECLARATION—affirmation, assertion. (Denial.)

DECREASE—diminish, lessen, reduce, wane, decline. (Increase, grow, enlarge.)

DEDICATE—consecrate, devote, offer, apportion.

DEED—act, transaction, exploit, document.

DEEM—judge, estimate, consider, esteem, suppose.

DEEP—profound, abtruse, hidden, extraordinarily wise. (Shallow, superficial.)

DEFACE—mar, spoil, injure, disfigure. (Beautify.)

DEFAULT—shortcoming, deficiency, defect, imperfection. (Sufficiency, satisfaction.)

DEFENCE—fortification, bulwark, vindication, justification, apology.

DEFEND—shield, vindicate. (Assault, accuse.)

DEFICIENT—incomplete, lacking. (Entire, perfect, whole.)

DEFILE—soil, smutch, besmear, begrime.

DEFINE—limit, bound. (Enlarge, expand.)

DEFRAY—pay, settle, liquidate, satisfy, clear.

DEGREE—grade, extent, measure, ratio, standard.

DELIBERATE, *a.*—circumspect, wary, cautious. (Heedless, thoughtless.)

DELICACY—nicety, dainty, tit-bit, taste, refinement, modesty. (Grossness, coarseness, vulgarity, indecorum.)

DELICATE—dainty, refined. (Coarse, beastly.)

DELICIOUS—savory, palatable, luscious, charming, delightful. (Offensive, nasty, odious, shocking, nauseous.)

DELIGHT—gratification, felicity. (Mortification, vexation.)

DELIVER—transfer, consign, utter, liberate, declare. (Keep, retain, restrain, check, bridle.)

DEMONSTRATE—prove, show, manifest. (Mystify, obscure.)

DEPART—quit, vacate, retire, withdraw, remove.

DEPRIVE—strip, bereave, despoil. (Invest, equip.)

DEPUTE—commission, delegate, accredit, entrust.

DERISION—ridicule, scoffing, mockery, raillery, chaff, *badinage*. (Awe, dread, reverence.)

DERIVATION—origin, source, spring, emanation, etymology.

DESCRIBE—delineate, portray, style, specify, characterize.

DESECRATE—profane, blaspheme, revile. (Consecrate, sanctify.)

DESERVE—merit, be entitled to, earn, justify.

DESIGN, *n.*—delineation, illustration, sketch, plan, drawing, portraiture, draught, projection, scheme, proposal, outline.

DESIRABLE—eligible, suitable, acceptable. (Unfit, objectionable.)

DESIRE, *n.*—wish, longing, hankering, appetite.

DESOLATE, *a.*—lonely, solitary, bereaved, forlorn, forsaken, deserted, bleak, dreary. (Befriended, social, festive.)

DESPERATE—frenzied, frantic, furious. (Calm, composed, moderate.)

DESTINY—fatality, doom, predestination, decree, fate. (Casualty, accident, contingency, chance.)

DESTRUCTIVE—mischievous, disastrous, deleteri- (Creative, beneficial.)

DESUETUDE—disuse, discontinuance. (Use, habit, practice.)

DESULTORY—immethodical, disconnected, rambling, discontinuous, interrupted, fitful, intermittent. (Continuous, consecutive, constant.)

DETAIL, *n.*—particular, item, count, specialty, individuality.

DETAIL, *v.*—particularize, enumerate, specify. (Generalize.)

DETER—discourage, dissuade. (Encourage, incite.)

DETRIMENT—damage, loss. (Benefit, improvement, betterment.)

DEVELOP—unfold, expand, increase. (Extirpate.)

DEVOID—wanting, destitute, bereft, denuded, bare, emptied, void. (Provided, supplied, furnished.)

DEVOTED—destined, consecrated, sworn to.

DICTATE—enjoin, order, prescribe, mark out.

DICTATORIAL—authoritative, imperative, overbearing, imperious, arbitrary, domineering.

DIE—expire, perish, depart this life, cease.

DIET—food, victuals, nourishment, aliment, board, sustenance, fare, viands, meal, repast, *menu*.

DIFFER—vary, diverge, disagree, bicker, nag, split. (Accord, harmonize.)

DIFFERENT—various, diverse, unlike. (Identical.)

DIFFICULT—hard, tough, laborious, arduous, formidable. (Easy, facile, manageable, pliant.)

DIFFUSE—discursive, digressive, diluted. (Condensed, concise, terse.)

DIGNIFY—elevate, exalt, ennoble, honor, advance, promote. (Degrade, disgrace, demean, vulgarize.)

DILATE—widen, extend, enlarge, expand, descant, expatiate. (Contract, narrow, compress, reduce.)

DILATORY—slow, tardy, slow-paced, procrastinating, lagging, dawdling. (Prompt, peremptory, quick, instant.)

DILIGENCE—zeal, ardor, assiduity. (Indolence.)

DIMINISH—lessen, reduce, curtail, retrench, bate, abate, shorten, contract. (Increase, augment, aggrandize, enlarge.)

DISABILITY—incapacity, unfitness. (Power.)

DISCERN—descry, perceive, distinguish, espy, scan, recognize, understand, discriminate. (Ignore.)

DISCIPLINE—order, training, drill, schooling.) (Laxity, disorder, confusion, anarchy.)

DISCOVER—detect, find, unveil, reveal, open, expose, publish, disclose. (Cover, conceal, hide.)

DISCREDITABLE — disreputable, reprehensible, blameworthy, shameful, scandalous, flagrant. (Exemplary, laudable, commendable.)

DISCREET—prudent, politic, cautious, wary, guarded, judicious. (Reckless, heedless, rash, unadvised, foolhardy, precipitate.)

DISCREPANCY—disagreement, discordance, incongruity, disparity, unfitness, clash, jar. (Concord, unison, harmony, congruity.)

DISCRIMINATION — distinction, differentiation, discernment, appreciation, acuteness, judgment, tact, nicety. (Confusion.)

DISEASE—illness, sickness, ailment, indisposition, complaint, malady, disorder. (Health, sanity, soundness, robustness.)

DISGRACE, *n.*—stigma, reproach, brand, dishonor, shame, scandal, odium, infamy. (Honor.)

DISGUST—distate, loathing, nausea, aversion, revulsion, abhorrence. (Predilection, partiality, inclination, bias.)

DISHONEST—fraudulent, unfair, tricky, unjust (Straightforward, open, sincere, honest, fair, right just impartial.)

DISMAY, *v.*—alarm, startle, scare, frighten, affright terrify, astound, appal, daunt. (Assure, cheer.)

DISMAY, *n.*—terror, dread, fear, fright. (Courage.)

DISMISS—send off, discharge, disband. (Instal retain, keep.)

DISPEL—scatter, disperse, dissipate, drive off chase. (Collect, rally, summon, gather.)

DISPLAY, *v.*—exhibit, show, parade. (Conceal.)

DISPOSE—arrange, place, order, marshal, rank, group, assort, distribute, co-ordinate, collocate. (Derange, embroil, jumble, muddle, huddle.)

DISPUTE, *v.*—discuss, debate, wrangle, controvert, contend. (Homologate, acquiesce in, assent to.)

DISPUTE. *n.*—argument, controversy, contention, polemic. (Homologation, acquiesence.)

DISTINCT—separate, detached. (Joined, involved.)

DISTINGUISH—perceive, separate. (Confound.)

DISTINGUISHED—famous, noted, marked, eminent, celebrated, illustrious. (Obscure, mean.)

DISTRACT—divert, disconcert, perplex, bewilder, fluster, dazzle. (Observe, study, note, mark.)

DISTRIBUTE—disperse, disseminate, dispense, retail, apportion, consign, dole out. (Accumulate.)

DISTURB—derange, displace, unsettle, trouble, vex, worry, annoy. (Compose, pacify, quiet, soothe.)

DIVIDE—disjoin, part, separate, sunder, sever, cleave, split, rend, partition, distribute. (Constitute, unite.)

DIVINE, *a.*—God-like, holy, heavenly. (Devilish.)

DIVINE, *n.*—clergyman, churchman, priest, pastor, shepherd, parson, minister. (Layman.)

DO—effect, make, accomplish, transact, act.

DOCILE—teachable, willing. (Refractory, stubborn, obstinate.)

DOCTRINE—teaching, lore, tenet, dogma, articles of faith, creed. (Ignorance, superstition.)

DOLEFUL—woeful, dismal. (Joyous, merry.)

DOOM, *n*,—sentence, fate, lot, destiny, decree.

DOUBT—uncertainty, skepticism, hesitation. (Certainty, faith.)

DRAW—pull, attract, inhale, sketch, delineate.

DREAD, *n.*—fear, horror, alarm, terror, dismay, apprehension. (Confidence, fearlessness.)

DREADFUL—fearful, alarming, formidable, portentous, direful, terrible, horrid, awful. (Mild, winsome, gentle.)

DRESS, *n.*—clothing, raiment, attire, apparel, clothes, *trousseau*. (Nudity, nakedness.)

DRIFT—tendency, direction, course, bearing, tenor

DROLL—funny, laughable, grotesque, farcical, odd (Dull, serious, solemn, grave.)

DRY, *a.*—arid, parched, bald, flat, dull. (Aqueous, green, fresh, juicy, interesting.)

DUE—owing, indebted, just, fair, proper.

DULL—heavy, sad, commonplace, gloomy, stupid. (Bright, gay, brilliant.)

DUNCE—blockhead, ignoramus, simpleton, donkey, ninny, dolt, booby, goose, dullard, numskull, dunderpate, clodhopper. (Sage, genius, man of talent, wit.)

DURABLE—abiding, lasting. (Evanescent.)

DWELL—stay, abide, sojourn, remain, tarry, stop. (Shift, wander, remove, tramp.)

DWINDLE—pine, waste, shrink, shrivel, diminish.

EAGER—keen, desirous, craving, ardent, impatient, intent, impetuous. (Loth, reluctant.)

EARN—gain, win, acquire. (Lose, miss, forfeit.)

EARNEST, *a.*—serious, resolved. (Trifling, giddy, irresolute, fickle.)

EARNEST, *n.*—pledge, gage, deposit, caution.

EASE, *n.*—content, rest, satisfaction, comfort, repose. (Worry, bother, friction, agitation, turmoil.)

EASE, *v.*—calm, console, appease, assuage, allay, mitigate. (Worry, fret, alarm, gall, harass.)

EASY—light, comfortable, unconstrained. (Hard, difficult, embarrassed, constrained.)

ECCENTRIC—wandering, irregular, peculiar, odd, unwonted, extraordinary, queer, nondescript. (Orderly, customary.)

ECONOMICAL—frugal, thrifty, provident. (Squandering, wasteful.)

EDGE—verge, brink, brim, rim, skirt, hem.

EFFECT, *v.*—produce, bring about, execute.

EFFECTIVE—efficient, operative, powerful, efficacious, competent. (Impotent, incapable, incompetent, inefficient.)

EFFICACY—efficiency, virtue, competence, agency, instrumentality.

ELIMINATE—expel, weed, thin, decimate, exclude, bar, reject, repudiate, winnow, eject, cast out. (Include, comprehend, incorporate, embrace.)

ELOQUENCE—oratory, rhetoric, declamation, facundity, grandiloquence, fluency. (Mumbling, stammering.)

ELUCIDATE—clear up, unfold, simplify, explain, decipher, unravel, disentangle. (Darken, obscure.)

ELUDE—escape, avoid, shun, slip, disappear, shirk.

EMBARRASS—perplex, entangle, involve, impede. (Relieve, unravel.)

EMBELLISH—adorn, decorate, beautify. (Tarnish, disfigure.)

EMBOLDEN—animate, encourage, cheer, instigate, impel, urge, stimulate. (Discourage, dispirit, dampen, depress.)

EMINENT—exalted, lofty, prominent, renowned, distinguished, famous, glorious, illustrious. (Base, obscure, low, unknown.)

EMIT—send out, despatch, spirt, publish, promulgate, edit. (Reserve, conceal, hide.)

EMOTION—feeling, sensation, pathos, nerve, ardor, agitation, excitement. (Apathy, frigidity, phlegm, *nonchalance.*)

EMPLOY—occupy, engage, utilize, exercise, turn to account, exploit, make use of.

ENCOMPASS—encircle, surround, gird, beset.

ENCOUNTER, *v.*—meet, run against, clash.

ENCOUNTER, *n.*—attack, conflict, assault, onset, engagement.

END, *n.*—object, aim, result, purpose, conclusion, upshot, termination. (Beginning, motive.)

ENDEAVOR, *v.*—attempt, try, essay, strive.

ENDURANCE—stay, stability, stamina, fortitude.

ENDURE—sustain, bear, brook, undergo.

ENEMY—foe, antagonist, adversary, opponent. (Friend, ally.)

ENERGETIC—active, vigorous, sinewy, nervous, forcible. (Lazy, languid, inert, flabby, flaccid, slack, effete.)

ENGAGE—occupy, busy, entice, captivate.

ENGROSS—monopolize, absorb, take up.

ENGULF—swallow up, drown, submerge, bury.

ENJOIN—order, command, decree, ordain, direct, appoint, prescribe, bind, impose, stipulate.

ENJOYMENT—pleasure, relish, zest. (Privation, grief, misery.)

ENLARGE—expand, widen, augment, broaden, increase, extend. (Diminish, narrow, straighten.)

ENLIGHTEN—illumine, instruct. (Darken, befog, mystify.)

ENLIVEN—cheer, animate, exhilarate, brighten, incite, inspire. (Sadden, deaden, mortify.)

ENMITY—hostility, hatred, antipathy, aversion, detestation. (Love, fondness, predilection.)

ENORMOUS—huge, immense, vast, stupendous, monstrous, gigantic, colossal, elephantine. (Tiny, little, minute, puny, petty, diminutive, infinitesimal, dwarfish.)

ENOUGH—sufficient, adequate. (Short, scrimp, insufficient.)

ENRAGED—infuriated, wrathful, wroth, rabid, mad, raging. (Pacified, calmed, lulled, assuaged.)

ENRAPTURE—captivate, fascinate, enchant, bewitch, ravish, transport, entrance. (Irritate, gall, shock, repel.)

ENROLL—enlist, register, enter, record.

ENTERPRISE—undertaking, endeavor, adventure, pursuit.

ENTHUSIASM—ardor, zeal, glow, unction, fervor. (Coolness, indifference, apathy, *nonchalance.*)

ENTHUSIAST—visionary, fanatic, devotee, zealot.

EQUAL—even, level, co-ordinate, balanced, alike, equable, equitable. (Unequal, disproportionate.)

ERADICATE—root out, extirpate. (Cherish.)

ERRONEOUS—fallacious, inaccurate, incorrect, untrue, false, inexact. (Accurate, just, right.)

ERROR—mistake, blunder, slip, delusion, fallacy, deception. (Truth, fact, verity, gospel, veracity.)

ESPECIALLY—chiefly, particularly, peculiarly.

ESSAY—endeavor, experiment, trial, attempt, venture, dissertation, treatise, disquisition, tract.

ESTABLISH—settle, fix, set, plant, pitch, lay down, confirm, authenticate, substantiate, verify.

ESTEEM, *n.*—value, appreciation, honor, regard. (Contempt, depreciation, disparagement.)

ESTIMATE, *v.*—value, assess, rate, appraise, gauge.

ETERNAL—everlasting, perpetual, endless, immortal, infinite. (Finite, transitory, temporary.)

EVADE—avoid, shun, elude, dodge, parry.

EVEN—plain, flat, level, smooth. (Uneven, rough, indented, protuberant.)

EVENT—occurrence, incident, affair, transaction, contingency.

EVIL—ill, harm, mischief, disaster, bane, calamity, catastrophe. (Good, benefit, advantage, boon.)

EXACT, *a.*—precise, literal, particular, correct.

EXAMINATION—investigation, inquiry, search, research, scrutiny, exploration, test, sitting, trial.

EXCEED—excel, outdo, transcend, surpass.

EXCEPTIONAL—uncommon, unusual, rare, extraordinary. (General, ordinary, regular, normal.)

EXCITE—urge, rouse, stir, awaken. (Assuage, calm, still, tranquilize.)

EXCURSION—tour, trip, expedition, ramble.

EXEMPT—free, absolved, cleared, discharged. (Implicated, included, bound, obliged.)

EXERCISE, *n.*—operation, practice, office, action, performance. (Stagnation, rest, stoppage.)

EXHAUSTIVE—complete, thorough, out-and-out.

EXIGENCY—predicament, emergency, crisis, push, pass, turning point, conjecture.

EXPRESS, *v.*—utter, tell, declare, signify.

EXTRAVAGANT — excessive, prodigal, profuse, wasteful, lavish, thriftless. (Penurious, stingy.)

FABLE—parable, tale, myth, romance. (Truth, fact, history, event, deed.)

FACE—aspect, visage, countenance.

FACETIOUS—pleasant, jocular. (Serious.)

FACTOR—manager, agent, officer.

FAIL—fall short, be deficient. (Accomplish.)

FAINT—feeble, languid. (Forcible.)

FAIR—clear. (Stormy.)

FAIR—equitable, honest, reasonable. (Unfair.)

FAITH—creed. (Unbelief, infidelity.)

FAITHFUL—true, loyal, constant. (Faithless.)

FAITHLESS—perfidious, treacherous. (Faithful.)

FALL—drop, droop, sink, tumble. (Rise.)

FAME—renown, reputation.

FAMOUS—celebrated, renowned. (Obscure.)

FANCIFUL—capricious, fantastical, whimsical.

FANCY—imagination.

FAST—rapid, quick, fleet, expeditious. (Slow.)

FATIGUE—weariness, lassitude. (Vigor.)

FEAR—timidity, timorousness. (Bravery.)

FEELING—sensation, sense.

FEELING—sensibility. (Insensibility.)

FEROCIOUS—fierce, savage, wild. (Mild.)

FERTILE—fruitful, prolific, plenteous. (Sterile.)

FICTION—falsehood, fabrication. (Fact.)

FIGURE—allegory, emblem, metaphor, symbol, picture, type.

FIND—descry, discover, espy. (Lose, overlook.)

FINE, *a.*—delicate, nice. (Coarse.)

FINE, *n.*—forfeit, forfeiture, mulct, penalty.

FIRE—glow, heat, warmth.

FIRM—constant, solid, steadfast, fixed. (Weak.)

FIRST—foremost, chief, earliest. (Last.)

FIT—accommodate, adapt, adjust, suit.

FIX—determine, establish, settle, limit.

FLAME—blaze, flare, flash, glare.

FLAT—level, even.

FLEXIBLE—pliant, pliable, ductile. (Inflexible.)

FLOURISH—prosper, thrive. (Decay.)

FLUCTUATING—wavering, hesitating, oscillating, vacillating, change. (Firm, steadfast, decided.)

FLUENT—flowing, glib, voluble, unembarrassed, ready. (Hesitating.)

FOLKS—persons, people, individuals.

FOLLOW—succeed, ensue, imitate, copy, pursue.

FOLLOWER—partisan, disciple, adherent, retainer, pursuer, successor.

FOLLY—silliness, foolishness, imbecility, weakness. (Wisdom.)

FOND—enamored, attached, affectionate. (Distant.)

FONDNESS—affection, attachment, kindness, love. (Aversion.)

FOOLHARDY—venturesome, incautious, hasty, adventurous, rash. (Cautious.)

FOOLISH—simple, silly, irrational, brainless, imbecile, crazy, absurd, preposterous, ridiculous, nonsensical. (Wise, discreet.)

FOP—dandy, dude, beau, coxcomb, puppy, jackanapes. (Gentlemen.)

FORBEAR—abstain, refrain, withhold.

FORCE, *n.*—strength, vigor, dint, might, energy, power, violence, army, host.

FORCE, *v.*—compel. (Persuade.)

FORECAST—forethought, foresight, premeditation, prognostication.

FOREGO—quit, relinquish, let go, waive.

FOREGOING—antecedent, anterior, preceding, previous, prior, former.

FORERUNNER—herald, harbinger, precursor.

FORESIGHT—forethought, forecast, premeditation.

FORGE—coin, invent, frame, feign, fabricate.

FORGIVE—pardon, remit, absolve, acquit, excuse.

FORLORN—forsaken, abandoned, deserted, desolate, lone, lonesome.

FORM, *n.*—ceremony, solemnity, observance, rite, figure, shape, conformation, fashion, appearance, representation, semblance.

FORM, *v.*—make, create, produce, constitute, arrange, fashion, mould, shape.

FORMAL—ceremonious, precise, exact, stiff, methodical, affected. (Informal, natural.)

FORMER—antecedent, anterior, previous, prior, preceding, foregoing.

FORSAKEN—abandoned, forlorn, deserted, desolate, lone, lonesome.

FORTHWITH—immediately, directly, instantly, instantaneously. (Anon.)

FORTITUDE—endurance, resolution, fearlessness, dauntlessness. (Weakness.)

FORTUNATE—lucky, happy, auspicious, successful, prosperous. (Unfortunate.)

FORTUNE—chance, fate, luck, doom, possession, destiny, property, riches.

FOSTER—cherish, nurse, tend, harbor. (Neglect.)

FOUL—impure, nasty, filthy, dirty, unclean, defiled. (Pure, clean.)

FRACTIOUS—cross, captious, petulent, splenetic, touchy, testy, peevish, fretful. (Tractable.)

FRAGILE—brittle, frail, delicate, feeble. (Strong.)

FRAGMENTS—pieces, scraps, leavings, remnants, chips, remains.

FRAILTY—weakness, failing, foible, imperfection, fault, blemish. (Strength.)

FRAME, *v.*—construct, invent, coin, fabricate, feign, forge, mold, make, compose.

FRANCHISE—right, exemption, immunity, privilege, freedom, suffrage.

FRANK—artless, candid, sincere, free, easy, open, familiar, ingenious, plain. (Tricky, insincere.)

FRANTIC — distracted, furious, raving, frenzied, mad. (Quiet, subdued.)

FRAUD—deceit, deception, duplicity, guile, cheat, imposition. (Honesty.)

FREAK—fancy, humor, vagary, whim, caprice, crochet. (Purpose, resolution.)

FREE, *a.*—liberal, generous, bountiful, bounteous, munificent, frank, artless, candid, familiar, open, independent, unconfined, unreserved, unrestricted, exempt, clear, loose, easy, careless. (Slavish, stingy, artful, costly.)

FREE, *v.*—release, set free, deliver, rescue, liberate, enfranchise, affranchise, emancipate, exempt. (Enslave, bind.)

FREEDOM—liberty, independence, unrestraint, familiarity, franchise, exemption. (Slavery.)

FREQUENT—often, common, general. (Rare.)

FRET—gall, chafe, agitate, irritate, vex.

FRIENDLY—amicable, social, sociable. (Distant, reserved, cool.)

FRIGHTFUL—fearful, dreadful, dire, direful, awful, terrific, horrible, horrid.

FRIVOLOUS—trifling, trivial, petty. (Serious.)

FRUGAL—provident, economical, saving. (Wasteful, extravagant.)

FRUITFUL—fertile, prolific, productive, abundant, plentiful, plenteous. (Barren, sterile.)

FRUITLESS—vain, useless, idle, bootless, unavailing, without avail.

FRUSTRATE—defeat, foil, balk, disappoint.

FULFILL—accomplish, effect, complete.

FULLY—completely, abundantly, perfectly.

FULSOME — coarse, gross, sickening, offensive, rank. (Moderate.)

FURIOUS—violent, boisterous, vehement, dashing, sweeping, rolling, impetuous, frantic, distracted, stormy, angry, raging, fierce. (Calm.)

FUTILE—trifling, trivial, frivolus. (Effective.)

GAIN, *n.*—profit, emolument, advantage, benefit, winnings, earnings. (Loss.)

GAIN, *v.*—get, acquire, obtain, attain, procure, earn, win, achieve, reap, realize, reach. (Lose.)

GALLANT—brave, bold, courageous, gay, showy, fine, intrepid, fearless, heroic.

GALLING—chafing, irritating. (Soothing.)

GAME—play, pastime, diversion, amusement.

GANG—band, horde, company, troop, crew.

GAP—breach, chasm, hollow, cavity, cleft, clevice, rift, chink.

GARNISH—embellish, adorn, beautify, decorate.

GATHER—pick, cull, assemble, muster, infer, collect. (Scatter.)

GAUDY—showy, flashy, tawdry, gay, glittering, bespangled. (Sombre.)

GAUNT—emaciated, scraggy, skinny, meagre, lank, attenuated, spare, lean, thin. (Well-fed.)

GAY—cheerful, merry, lively, jolly, sprightly, blithe. (Solemn.)

GENERATE—form, make, beget, produce.

GENERATION—formation, race, breed, stock, kind, age, era.

GENEROUS—beneficent, noble, honorable, bountiful, liberal, free. (Niggardly.)

GENIAL—cordial, hearty, festive. (Distant, cold.)

GENIUS—intellect, invention, talent, taste, nature, character, adept.

GENTEEL—refined, polished, fashionable, polite, well-bred. (Boorish.)

GENTLE—placid, mild, bland, meek, tame, docile. (Rough, uncouth.)

GENUINE—real, true, unaffected. (False.)

GESTURE—attitude, action, posture.

GET—obtain, earn, gain, attain, procure, achieve.

GHASTLY—pallid, wan, hideous, grim, shocking.

GHOST—spectre, sprite, apparition, phantom.

GIBE—scoff, sneer, flout, jeer, mock, taunt, deride.

GIDDY—unsteady, thoughtless. (Steady.)

GIFT—donation, benefaction, grant, alms, gratuity, boon, present, faculty, talent. (Purchase.)

GIGANTIC—colossal, huge, enormous, prodigious, vast, immense. (Diminutive.)

GIVE—grant, bestow, confer, yield, impart.

GLAD—pleased, cheerful, joyful, gladsome, cheering, gratified. (Sad.)

GLEAM—glimmer, glance, glitter, shine, flash.

GLEE—gayety, merriment, mirth, joviality, joy, hilarity. (Sorrow.)

GLIDE—slip, slide, run, roll on.

GLIMMER, *v.*—gleam, flicker, glitter.

GLIMPSE—glance, look, glint.

GLITTER—gleam, shine, glisten, glister, radiate.

GLOOM—cloud, darkness, dimness, blackness, dullness, sadness. (Light, brightness, joy.)

GLOOMY—lowering, lurid, dim, dusky, sad, glum. (Bright, clear.)

GLORIFY—magnify, celebrate, adore, exalt.

GLORIOUS—famous, renowned, distinguished, exalted, noble. (Infamous.)

GLORY—honor, fame, renown, splendor, grandeur. (Infamy.)

GLUT—gorge, stuff, cram, cloy, satiate, block up.

GO—depart, proceed, move, budge, stir.

GOD—Creator, Lord, Almighty, Jehovah, Omnipotence, Providence.

GODLY—righteous, devout, holy, pious, religious.

GOOD—benefit, weal, advantage, profit. (Evil.)

GOOD, *a.*—virtuous, righteous, upright, just, true. (Wicked, bad.)

GORGE, glut, fill, cram, stuff, satiate.

GORGEOUS—superb, grand, magnificent, splendid. (Plain, simple.)

GOVERN—rule, direct, manage, command.

GOVERNMENT—rule, state, control, sway.

GRACEFUL—becoming, comely, elegant, beautiful. (Awkward.)

GRACIOUS—merciful, kindly, beneficent.

GRADUAL—slow, progressive. (Sudden.)

GRAND—majestic, stately, dignified, lofty, elevated, exalted, splendid, gorgeous, superb, magnificent, sublime, pompous. (Shabby.)

GRANT—bestow, impart, give, yield, cede, allow, confer, invest.

GRANT—gift, boon, donation.

GRAPHIC—forcible, telling, picturesque, pictorial.

GRASP—catch, seize, gripe, clasp, grapple.

GRATEFUL—agreeable, pleasing, welcome, thankful. (Harsh.)

GRATIFICATION—enjoyment, pleasure, delight, reward. (Disappointment.)

GRAVE, *a.*—serious, sedate, solemn, sober, pressing, heavy. (Giddy.)

GRAVE, *n.*—tomb, sepulchre, vault.

GREAT—big, huge, large, majestic, vast, grand, noble, august. (Small.)

GREEDINESS—avidity, eagerness. (Generosity.)

GRIEF—affliction, sorrow, trial, tribulation. (Joy.)

GRIEVE—mourn, lament, sorrow, pain, wound, hurt, bewail. (Rejoice.)

GRIEVOUS—painful, afflicting, heavy, unhappy.

GRIND—crush, oppress, grate, harass, afflict.

GRISLY—terrible, hideous, grim, ghastly, dreadful. (Pleasing.)

GROSS—coarse, outrageous, unseemly, shameful, indelicate. (Delicate.)

GROUP—assembly, cluster, collection, clump, order.

GROVEL—crawl, cringe, fawn, sneak.

GROW—increase, vegetate, expand, advance. (Decay, diminution,)

GROWL—grumble, snarl, murmur, complain.

GRUDGE—malice, rancor, spite, pique, hatred.

GRUFF—rough, rugged, blunt, rude, harsh, surly, bearish. (Pleasant.)

GUILE—deceit, fraud. (Candor.)

GUILTLESS—harmless, innocent.

GUILTY—culpable, sinful, criminal.

HABIT—custom, practice.

HAIL—accost, address, greet, salute, welcome.

HAPPINESS—beatitude, blessedness, bliss, felicity. (Unhappiness.)

HARBOR—haven, port.

HARD—firm, solid. (Soft.)

HARD—arduous, difficult. (Easy.)

HARM—injury, hurt, wrong, infliction. (Benefit.)

HARMLESS—safe, innocuous, innocent. (Hurtful.)

HARSH—rough, rigorous, severe, gruff. (Gentle.)

HASTEN—accelerate, dispatch, expedite. (Delay.)

HASTY—hurried, ill-advised. (Deliberate.)

HATEFUL—odious, detestable. (Lovable.)

HATRED—enmity, ill-will, rancor. (Friendship.)

HAUGHTINESS—arrogance, pride. (Modesty.)

HAUGHTY—arrogant, disdainful, supercilious

HAZARD—risk, venture.

HEALTHY—salubrious, salutary. (Unhealthy.)

HEAP—accumulate, amass, pile.

HEARTY—cordial, sincere, warm. (Insincere.)

HEAVY—burdensome, ponderous. (Light.)

HEED—care, attention.

HEIGHTEN—enhance, exalt, elevate, raise.

HEINOUS—atrocious, flagrant. (Venial.)

HELP—aid, assist, relieve, succor. (Hinder.)

HERETIC—sectary, sectarian, schismatic, dissenter, non-conformist.

HESITATE—falter, stammer, stutter.

HIDEOUS—grim, ghastly, grisly. (Beautiful.)

HIGH—lofty, tall, elevated. (Deep.)

HINDER—impede, obstruct, prevent, (Help.)

HINT—allude, refer, suggest, intimate, insinuate.

HOLD—detain, keep, retain.

HOLINESS—sanctity, piety, sacredness.

HOLY—devout, pious, religious.

HOMELY—plain, ugly, coarse. (Beautiful.)

HONESTY—integrity, probity, uprightness. (Dishonesty.)

HONOR, *v.*—respect, reverence. (Dishonor.)

HOPE—confidence, expectation, trust.

HOPELESS—desperate.

HOT—ardent, burning, fiery. (Cold.)

HOWEVER—nevertheless, notwithstanding, yet.

HUMBLE—modest, submissive, plain, unostentatious, simple. (Haughty.)

HUMBLE—degrade, humiliate, mortify. (Exalt.)

HUMOR—mood, temper.

HUNT—seek, chase.

HURTFUL—noxious, pernicious. (Beneficial.)

HUSBANDRY—cultivation, tillage.

HYPOCRITE—dissembler, imposter, canter.

HYPOTHESIS—theory, supposition.

IDEA—thought, imagination.

IDEAL—imaginary, fancied. (Actual.)

IDLE—indolent, lazy. (Industrious.)

IGNOMINIOUS—shameful, scandalous, infamous. (Honorable.)

IGNOMINY—shame, disgrace, obloquy, reproach.

IGNORANT—unlearned, illiterate, uninformed uneducated. (Knowing.)

ILL, *n.*—evil, wickedness, misfortune, mischief, harm. (Good.)

ILL, *a.*—sick, indisposed, diseased. (Well.)

ILL-TEMPERED—crabbed, sour, acrimonious, surly. (Good-natured.)

ILL-WILL—enmity, antipathy. (Good-will.)

ILLEGAL—unlawful, illicit, contraband, illegitimate. (Legal.)

ILLIMITABLE—boundless, immeasurable, infinite.

ILLITERATE—unlettered, unlearned, untaught, uninstructed. (Learned, educated.)

ILLUSION—fallacy, deception, phantasm.

ILLUSORY—imaginary, chimerical. (Real.)

ILLUSTRATE—explain, elucidate, clear.

ILLUSTRIOUS—celebrated, noble, eminent, famous, renowned. (Obscure.)

IMAGE—likeness, picture, representation, effigy.

IMAGINARY—ideal, fanciful, illusory. (Real.)

IMAGINE—conceive, fancy, apprehend, think.

IMBECILITY—silliness, senility, dotage.

IMITATE—copy, ape, mimic, mock, counterfeit

IMMACULATE—unspotted, spotless, unsullied, stainless. (Soiled.)

IMMEDIATE—pressing, instant, next, proximate.

IMMEDIATELY—instantly, forthwith, directly.

IMMENSE—vast, enormous, huge, prodigious.

IMMUNITY—privilege, prerogative, exemption.

IMPAIR—injure, diminish, decrease.

IMPART—reveal, divulge, disclose, discover, afford.

IMPARTIAL—just, equitable, unbiased. (Partial.)

IMPASSIONED—glowing, burning, fiery, intense.

IMPEACH—accuse, charge, arraign, censure.

IMPEDE—hinder, retard, obstruct. (Help.)

IMPEDIMENT—obstruction, hindrance, obstacle, barrier. (Aid.)

IMPEL—animate, induce, incite, instigate. embolden. (Retard.)

IMPENDING—imminent, threatening.

IMPERATIVE—commanding, authoritative.

IMPERFECTION—fault, blemish, defect, vice.

IMPERIL—endanger, hazard, jeopardize.

IMPERIOUS—commanding, dictatorial, imperative, authoritative, lordly, overbearing, domineering.

IMPERTINENT—intrusive, meddling, officious, rude, saucy, impudent, insolent.

IMPETUOUS—violent, boisterous, furious, vehement. (Calm.)

IMPIOUS—profane, irreligious. (Reverent.)

IMPLICATE—involve, entangle, embarrass.

IMPLY—involve, comprise, infold, import, denote.

IMPORTANCE—signification, significance, avail, consequence, weight, gravity, moment.

IMPOSING—impressive, striking, majestic, august, noble, grand. (Insignificant.)

IMPOTENCE—weakness, incapacity, infirmity, frailty, feebleness. (Power.)

IMPOTENT—weak, feeble, helpless, enfeebled, nerveless, infirm. (Strong.)

IMPRESSIVE—stirring, forcible, exciting, moving.

IMPRISON—incarcerated, shut up, immure, confine. (Liberate.)

IMPRISONMENT—captivity, durance.

IMPROVE—amend, better, mend, reform, rectify, ameliorate, apply, use, employ. (Deteriorate.)

IMPROVIDENT—careless, incautious, imprudent, prodigal, wasteful, reckless, rash. (Thrifty.)

IMPUDENCE—assurance, impertinence, confidence, insolence, rudeness.

IMPUDENT—saucy, brazen, bold, impertinent forward, rude, insolent, immodest, shameless.

IMPULSE—incentive, incitement, instigation.

IMPULSIVE—rash, hasty, forcible. (Deliberate.)

IMPUTATION—blame, censure, reproach, charge.

INADVERTENCY—error, oversight, blunder, inattention, carelessness, negligence.

INCENTIVE—motive, inducement, impulse.

INCITE—instigate, excite, provoke, stimulate, urge, encourage, impel.

INCLINATION—leaning, slope, disposition, bent, tendency, bias, affection, attachment, wish, liking, desire. (Aversion.)

INCLINE, *v.*—slope, lean, slant, tend, bend, turn, bias, dispose.

INCLOSE—surround, shut in, fence in, cover, wrap.

INCLUDE—comprehend, comprise, contain, take in, embrace.

INCOMMODE—annoy, plague, molest, disturb, inconvenience, trouble. (Accommodate.)

INCOMPETENT—incapable, unable, inadequate.

INCREASE, *v.*—extend, enlarge, augment, dilate, expand, amplify, raise, enhance, aggravate, magnify, grow. (Diminish.)

INCREASE, *n.*—augmentation, accession, addition, enlargement, extension. (Decrease.)

INCUMBENT—obligatory.

INDEFINITE—vague, uncertain, unsettled, loose, lax. (Definite.)

INDICATE—point out, show, mark.

INDIFFERENCE—apathy, carelessness, listlessness, insensibility. (Application, assiduity.)

INDIGENCE—want, neediness, penury, poverty, destitution, privation. (Affluence.)

INDIGNATION—anger, wrath, ire, resentment.

INDIGNITY—insult, affront, outrage, opprobrium, obloquy, reproach, ignominy. (Honor.)

INDISCRIMINATE—promiscuous, chance, indistinct, confused. (Select, chosen.)

INDISPENSABLE—essential, necessary, requisite, expedient. (Unnecessary, supernumerary.)

INDISPUTABLE—undeniable, undoubted, incontestable, indubitable, unquestionable, infallible.

INDORSE—ratify, confirm, superscribe.

INDULGE—foster, cherish, fondle. (Deny.)

INEFFECTUAL—vain, useless, unavailing, fruitless, abortive, inoperative. (Effective.)

INEQUALITY—disparity, disproportion, dissimilarity, unevenness. (Equality.)

INEVITABLE—unavoidable, not to be avoided.

INFAMOUS—scandalous, shameful, ignominious, opprobrious, disgraceful. (Honorable.)

INFERENCE—deduction, corollary, conclusion.

INFERNAL—diabolical, fiendish, devilish, hellish.

INFEST—annoy, plague, harass, disturb.

INFIRM—week, feeble, enfeebled. (Robust.)

INFLAME—anger, irritate, enrage, chafe, incense, nettle, aggravate, embitter, exasperate. (Allay.)

INFLUENCE, *v.*—bias, sway, prejudice, preposess.

INFLUENCE, *n.*—credit, favor, reputation, weight, character, authority, sway, ascendency.

INFRINGE—invade, intrude, contravene, break, transgress, violate.

INGENUOUS—artless, candid, generous, sincere, open, frank, plain. (Crafty.)

INHUMAN—cruel, brutal, savage, barbarous, ruthless, merciless, ferocious. (Humane.)

INIQUITY—injustice, wrong, grievance.

INJURE—damage, hurt, deteriorate, wrong, spoil, aggrieve, harm, mar, sully. (Benefit.)

INJURIOUS—hurtful, baneful, pernicious, deleterious, noxious, prejudicial, wrongful. (Beneficial.)

INJUSTICE—wrong, iniquity, grievance. (Right.)

INNOCENT—guiltless, sinless, harmless, inoffensive, innoxious. (Guilty.)

INNOCUOUS—harmless, safe, innocent. (Hurtful.)

INORDINATE—intemperate, irregular, disorderly, excessive, immoderate. (Moderate.)

INQUIRY—investigation, examination, research, scrutiny, disquisition, question, interrogation.

INQUISITIVE—prying, peeping, curious, peering.

INSANE—deranged, delirous, demented. (Sane.)

INSANITY—madness, mental aberration, lunacy, delirium. (Sanity.)

INSINUATE—hint, intimate, suggest, infuse, introduce, ingratiate.

INSIPID—dull, flat, mawkish, tasteless, inanimate, vapid, lifeless. (Bright, sparkling.)

INSOLENT—rude, saucy, impertinent, abusive, pert, scurrilous, opprobrious, insulting, offensive.

INSPIRE—animate, exhilarate, enliven, breathe, cheer, inhale.

INSTABILITY—mutability, fickleness, mutableness, wavering. (Stability, firmness.)

INSTIGATE—stir up, persuade, animate, stimulate, incite, urge, encourage.

INSTIL—implant, inculcate, infuse, insinuate.

INSTRUCT—inform, teach, educate, enlighten.

INSTRUMENTAL—conducive, assistant, helping.

INSUFFICIENCY — incompetency, incapability, inadequacy, deficiency, lack.

INSULT—affront, outrage, indignity. (Honor.)

INSULTING—insolent, impertinent, abusive, rude.

INTEGRITY—uprightness, honesty, completeness, probity, entirety, entireness, purity. (Dishonesty.)

INTELLECT—understanding, sense, brains, mind, intelligence, ability, talent, genius. (Body.)

INTELLECTUAL—mental, metaphysical. (Brutal.)

INTELLIGIBLE—clear, obvious, plain. (Abstruse.)

INTEMPERATE—immoderate, excessive, drunken, nimious, inordinate. (Temperate.)

INTENSE—ardent, earnest, glowing, fervid, burning, vehement.

INTENT—design, purpose, intention, drift, view, aim, purport, meaning.

INTERCOURSE—commerce, connection, intimacy

INTERDICT—forbid, prohibit, inhibit, proscribe, debar, restrain from. (Allow.)

INTERFERE—meddle, intermeddle, interpose.

INTERMINABLE—endless, interminate, infinite, unlimited, illimitable, boundless. (Brief.)

INTERPOSE—intercede, arbitrate, mediate, interfere, meddle.

IMTERPRET—explain, expound, elucidate, unfold

INTIMATE—hint, suggest, insinuate, express, tell, signify, impart.

INTIMIDATE—dishearten, alarm, frighten, scare, appal, daunt, cow, browbeat. (Encourage.)

INTOLERABLE—insufferable, unbearable, insupportable, unendurable.

INTREPID—bold, brave, daring, fearless, dauntless, undaunted, courageous, valorous, valiant, heroic, gallant, chivalrous, doughty. (Cowardly, faint-hearted.)

INTRIGUE—plot, cabal, conspiracy, combination, artifice, ruse, *amour.*

INTRINSIC—real, true, genuine, sterling, native, natural. (Extrinsic.)

INVALIDATE—quash, cancel, overthrow, vacate, nullify, annul.

INVASION—incursion, irruption, inroad, aggression, raid, fray.

INVECTIVE—abuse, reproach, railing, censure, sarcasm, satire.

INVENT—devise, contrive, frame, find out, discover.

INVESTIGATION—examination, search, inquiry, research, scrutiny.

INVETERATE — confirmed, chronic, malignant. (Inchoate.)

INVIDIOUS—envious, hateful, odious, malignant.

INVIGORATE—brace, harden, nerve, strengthen, fortify. (Enervate.)

INVINCIBLE—unconquerable, impregnable, insurmountable.

INVISIBLE—unseen, imperceptible, impalpable.

INVITE—ask, call, bid, request, allure, attract.

INVOKE—invocate, call upon, appeal, refer, implore, beseech.

INVOLVE—implicate, entangle, compromise.

IRKSOME—wearisome, tiresome, tedious, annoying. (Pleasant.)

IRONY—sarcasm, satire, ridicule, raillery.

IRRATIONAL—foolish, silly, imbecile, brutish, absurd, ridiculous. (Rational.)

IRREGULAR—eccentric, anomalous, inordinate, intemperate. (Regular.)

IRRELIGIOUS—profane, godless, impious, sacrilegious, desecrating.

IRREPROACHABLE—blameless, spotless.

IRRESISTIBLE—resistless, irrepressible,

IRRESOLUTE —wavering, undetermined, undecided, vacillating. (Determined.)
IRRITABLE—excitable, irascible, susceptible, sensitive. (Calm.)
IRRITATE—aggravate, worry, embitter, madden.
ISSUE, *v.*—emerge, rise, proceed, flow, spring.
ISSUE, *n.*—end, upshot, effect, result, offspring.
JADE—harass, weary, tire, worry.
JANGLE—wrangle, conflict, disagree.
JARRING—conflicting, discordant, inconsonant.
JAUNT—ramble, excursion, trip.
JEALOUSY—suspicion, envy.
JEOPARD—hazard, peril, endanger.
JEST—joke, sport, divert, make game of.
JOURNEY—travel, tour, passage.
JOY—gladness, mirth, delight. (Grief.)
JUDGE—justice, referee, arbitrator.
JOYFUL—glad, rejoicing, exultant. (Mournful.)
JUDGMENT—discernment, discrimination.
JUSTICE—equity, right. Justice is right as established by law; equity according to the circumstances of each particular case. (Injustice.)
JUSTNESS—accuracy, correctness, precision.

KEEP—preserve, save. (Abandon.)
KILL—assassinate, murder, slay.
KINDRED—affinity, consanguinity, relationship.
KNOWLEDGE—erudition, learning. (Ignorance.)

LABOR—toil, work, effort, drudgery. (Idleness.)
LACK—need, deficiency, scarcity, insufficiency. (Plenty.)
LAMENT—mourn, grieve, weep. (Rejoice.)
LANGUAGE—dialect, idiom, speech, tongue.
LASCIVIOUS—loose, unchaste, lustful, lewd, lecherous. (Chaste.)
LAST—final, latest, ultimate. (First.)
LAUDABLE—commendable. (Blamable.)
LAUGHABLE—comical, droll, ludicrous. (Serious.)
LAWFUL—legal, legitimate, licit. (Illegal.)
LEAD—conduct, guide. (Follow.)
LEAN—meager. (Fat.)
LEARNED—erudite, scholarly. (Ignorant.)
LEAVE, *v.*—quit, relinquish.
LEAVE, *n.*—liberty, permission. (Prohibition.)
LIFE—existence, animation, spirit. (Death.)
LIFELESS—dead, inanimate.
LIFT—erect, elevate, exalt, raise. (Lower.)
LIGHT—clear, bright. (Dark.)
LIGHTNESS—flightiness, giddiness, levity, volatility. (Seriousness.)
LIKENESS—resemblance, similarity. (Unlikeness.)
LINGER—lag, loiter, tarry, saunter. (Hasten.)
LITTLE—diminutive, small. (Great.)
LIVELIHOOD—living, maintenance, subsistence.
LIVELY—jocund, merry, sportive, sprightly, vivacious. (Slow, languid, sluggish.)
LONG—extended, extensive. (Short.)
LOOK—appear, seem, aspect, glance, peep.
LOSE—miss, forfeit. (Gain.)
LOSS—detriment, damage, deprivation. (Gain.)
LOUD—clamorous, high-sounding, noisy. (Low, quiet.)
LOVE—affection. (Hatred.)
LOW—abject, mean. (Noble.)
LUNACY—derangement, insanity, mania, madness. (Sanity.)
LUSTER—brightness, brilliancy, splendor.
LUXURIANT—exuberant. (Sparse.)

MACHINATION—plot, intrigue, cabal, conspiracy. (Artlessness.)
MAD—crazy, delirious, insane, rabid, violent, frantic. (Sane, rational, quiet.)
MADNESS—insanity, fury, rage, frenzy.
MAGISTERIAL—august, dignified, majestic, pompous, stately.
MAKE—form, create, produce. (Destroy.)
MALEDICTION—anathema, curse, imprecation.
MALEVOLENT—malicious, virulent, malignant. (Benevolent.)
MALICE—spite, rancor, ill-feeling, grudge, animosity, ill-will. (Benignity.)
MALICIOUS—see malevolent.
MANACLE, *v.*—shackle, fetter, chain. (Free.)
MANAGE—contrive, concert, direct.
MANAGEMENT—direction, superintendence, care.
MANGLE—tear, lacerate, mutilate, cripple, maim.
MANIA—madness, insanity, lunacy.
MANIFEST, *v.*—reveal, prove, evince, exhibit, display, show.
MANIFEST, *a.*—clear, plain, evident, open, apparent, visible. (Hidden, occult.)
MANIFOLD—several, sundry, various, divers.
MANLY—masculine, vigorous, courageous, brave, heroic. (Effeminate.)
MANNER—habit, custom, way, air, look.
MANNERS—morals, habits, behavior, carriage.
MAR—spoil, ruin, disfigure. (Improve.)
MARCH—tramp, tread, walk, step, space.
MARGIN—edge, rim, border, brink, verge.
MARK, *n.*—sign, note, symptom, token, indication, trace, vestige, track, badge, brand.
MARK, *v.*—impress, print, stamp, engrave, note.
MARRIAGE—wedding, nuptials, matrimony.
MARTIAL—military, warlike, soldierlike.
MARVEL—wonderful, miracle, prodigy.
MARVELOUS—wondrous, wonderful, miraculous.
MASSIVE — bulky, heavy, weighty, ponderous, solid, substantial. (Flimsy.)
MASTERY—dominion, rule, sway, ascendancy.
MATCHLESS—unrivaled, unequaled, unparalleled, peerless, incomparable, inimitable, surpassing. (Common, ordinary.)
MATERIAL, *a.*—corporeal, bodily, physical, temporal, momentous. (Spiritual, immaterial.)

MAXIM—adage, apothegm, proverb, saying, by-word, saw.

MEAGER—poor, lank, emaciated, barren, dry, uninteresting. (Rich.)

MEAN, *a.*—stingy, niggardly, low, abject, vile, ignoble, degraded, contemptible, vulgar, despicable. (Generous.)

MEAN, *v.*—design, purpose, intend, contemplate, signify, denote, indicate.

MEANING—signification, import, acceptation, sense, purport.

MEDIUM—organ, channel, instrument, means.

MEDLEY—mixture, variety, diversity, miscellany.

MEEK—unassuming, mild, gentle. (Proud.)

MELANCHOLY—low-spirited, dispirited, dreamy, sad. (Jolly, buoyant.)

MELLOW—ripe, mature, soft. (Immature.)

MELODIOUS—tuneful, musical, silver, dulcet, sweet. (Discordant.)

MEMORABLE—signal, distinguished, marked.

MEMORIAL—monument, memento.

MEMORY—remembrance, recollection.

MENACE, *n.*—threat.

MEND—repair, amend, correct, better, ameliorate, improve, rectify.

MENTION—tell, name, communicate, impart, divulge, reveal, disclose, inform, acquaint.

MERCIFUL—compassionate, lenient, clement, tender, gracious, kind. (Cruel.)

MERCILESS—hard-hearted, cruel, unmerciful, pitiless, remorseless, unrelenting. (Kind.)

MERRIMENT—mirth, joviality, jollity. (Sorrow.)

MERRY—cheerful, mirthful, joyous, gay, lively, sprightly, hilarious, blithe, blithesome, jovial. sportive, jolly. (Sad.)

METAPHORICAL—figurative, allegorical.

METHOD—way, manner, mode, process, order, rule, regularity, system.

MIEN—air, look, manner, aspect, appearence.

MIGRATORY—roving, strolling, wandering, vagrant. (Settled, sedate, permanent.)

MIMIC—imitate, ape, mock.

MINDFUL—observant, attentive. (Heedless.)

MISCELLANEOUS—promicuous, indiscriminate.

MISCHIEF—injury, harm, damage, hurt. (Benefit.)

MISCREANT—caitiff, villain, ruffian.

MISERABLE—unhappy, wretched, distressed, afflicted. (Happy.)

MISERLY—stingy, niggardly, avaricious, griping.

MISERY—wretchedness, woe, destitution, penury, privation, beggary. (Happiness.)

MISFORTUNE—calamity, disaster, mishap, catastrophe. (Good luck.)

MISS—omit, lose, fall, miscarry.

MITIGATE—alleviate, relieve, abate. (Aggravate.)

MODERATE—temperate, abstemious, sober, abstinent. (Immoderate.)

MODEST—chaste, virtuous, bashful. (Immodest.)

MOIST—wet, damp, dank, humid. (Dry.)

MONOTONOUS—unvaried, tiresome. (Varied.)

MONSTROUS—shocking, dreadful, horrible, huge.

MONUMENT—memorial, record, remembrancer.

MOOD—humor, disposition, vein, temper.

MORBID—sick, ailing, sickly, diseased, corrupted. (Normal, sound.)

MOROSE—gloomy, sullen, surly, fretful, crabbed, crusty. (Joyous.)

MORTAL—deadly, fatal, human.

MOTION—proposition, proposal, movement.

MOTIONLESS—still, stationary, torpid, stagnant. (Active, moving.)

MOUNT—arise, rise, ascend, soar, tower, climb.

MOURNFUL—sad, sorrowful, lugubrious, grievous, doleful, heavy, (Happy.)

MOVE—actuate, impel, induce, prompt, instigate, persuade, stir, agitate, propel, push.

MULTITUDE—crowd, throng, host, mob, swarm.

MURDER, *v.*—kill, assassinate, slay, massacre.

MUSE, *v.*—meditate, contemplate, think, reflect, cogitate, ponder.

MUSIC—harmony, melody, symphony.

MUSICAL—tuneful, melodious, harmonious, sweet.

MUSTY—stale, sour, fetid. (Fresh, sweet.)

MUTE—dumb, silent, speechless.

MUTILATE—maim, cripple, disable, disfigure.

MUTINOUS—insurgent, seditious, tumultuous, turbulent, riotous. (Obedient, orderly.)

MUTUAL—reciprocal, interchanged, correlative. (Sole, solitary.)

MYSTERIOUS—dark, obscure, hidden, secret, dim, mystic, enigmatical, unaccountable. (Open, clear.)

MYSTIFY—confuse, perplex. (Clear, explain.)

NAKED—nude, bare, uncovered, unclothed, rough, rude, simple. (Covered, clad.)

NAME, *v.*—denominate, entitle, style, designate, term, call, christen.

NAME, *n.*—appellation, designation, denomination, title, cognomen, reputation, character, fame, credit, repute.

NARRATE—tell, relate, detail, recount, describe, enumerate, rehearse, recite.

NASTY—filthy, foul, dirty, unclean, impure, gross, indecent, vile.

NATION—people, community, realm, state.

NATIVE—indigenous, inborn, vernacular.

NATURAL—original, regular, normal, bastard. (Unnatural, forced.)

NEAR—nigh, neighboring, close, adjacent, contiguous, intimate. (Distant.)

NECESSARY—needful, expedient, essential, indispensable, requisite. (Useless.)

NECESSITATE—compel, force, oblige.

NECESSITY—need, occasion, exigency, emergency, urgency, requisite.

NEED, *n.*—necessity, distress, poverty, indigence, want, penury.

NEED, *v.*—require, want, lack.

NEGLECT, *v.*—disregard, slight, omit, overlook.

NEGLECT, *n.*—omission, failure, default, slight, negligence, remissness, carelessness.
NEIGHBORHOOD—environs, vicinity, nearness, adjacency, proximity.
NERVOUS—timid, timorous, shaky.
NEW—fresh, recent, novel. (Old.)
NEWS—tidings, intelligence, information.
NICE—exact, accurate, good, particular, precise, fine, delicate. (Careless, coarse, unpleasant.)
NIMBLE—active, brisk, lively, alert, quick, agile, prompt. (Awkward.)
NOBILITY—aristocracy, greatness, grandeur.
NOBLE—exalted, elevated, illustrious, great, grand, lofty. (Low.)
NOISE—cry, outcry, clamor, row, din, uproar, tumult. (Silence.)
NONSENSICAL—irrational, absurd, silly, foolish. (Sensible.)
NOTABLE—plain, evident, remarkable, striking, signal, rare. (Obscure.)
NOTE, *n.*—token, symbol, mark, sign, indication, remark, comment.
NOTED—distinguished, remarkable, eminent, renowned. (Obscure.)
NOTICE, *n.*—advice, notification, intelligence.
NOTICE, *v.*—mark, note, observe, attend to, heed.
NOTIFY, *v.*—publish, acquaint, apprise, inform.
NOTION—conception, idea, belief, opinion.
NOTORIOUS — conspicuous, open, obvious, ill-famed. (Unknown.)
NOURISH — nurture, cherish, foster, supply. (Starve, famish.)
NOURISHMENT—food, diet, sustenance, nutrition.
NOVEL—modern, new, fresh, recent, unused, rare, strange. (Old.)
NOXIOUS—hurtful, deadly poisonous, deleterious, baneful. (Beneficial.)
NULLIFY—annul, vacate, invalidate, quash, cancel, repeal. (Affirm.)
NUTRITION—food, diet, nutriment, nourishment.

OBDURATE—hard, callous, hardened, unfeeling, insensible. (Yielding, tractable.)
OBEDIENT—compliant, submissive, dutiful, respectful. (Obstinate.)
OBESE—corpulent, fat, adipose. (Attenuated.)
OBEY, *v.*—conform, comply, submit. (Rebel.)
OBJECT, *n.*—aim, end, purpose, design, mark.
OBJECT, *v.*—oppose, except to, contravene, impeach, deprecate. (Assent.)
OBNOXIOUS—offensive. (Agreeble.)
OBSCURE—undistinguished, unknown. (Distinguished.)
OBSTINATE—contumacious, headstrong, stubborn, obdurate. (Yielding.)
OCCASION—opportunity.
OFFENCE—affront, misdeed, misdemeanor, transgression, trespass.
OFFENSIVE—insolent, abusive. (Inoffensive.)
OFFICE—charge, function, place.
OFFSPRING—issue, progeny, children, posterity.
OLD—aged, superanuated, ancient, antique, antiquated, obsolete, old-fashioned. (Young, new.)
OMEN—presage, prognostic.
OPAQUE—dark. (Bright, transparent.)
OPEN—candid, unreserved, clear, fair. (Hidden.)
OPINION—notion, view, judgment, sentiment.
OPINIONATED—conceited, egotistical. (Modest.)
OPPOSE—resist, withstand, thwart. (Give way.)
OPTION—choice.
ORDER—method, system, regularity. (Disorder.)
ORIGIN—cause, occasion, beginning. (End.)
OUTLIVE—survive.
OUTWARD—external, outside, exterior. (Inner.)
OVER—above. (Under.)
OVERBALANCE—outweigh, preponderate.
OVERBEAR—bear down, overwhelm, overpower.
OVERBEARING—haughty, arrogant. (Gentle.)
OVERFLOW—inundation, deluge.
OVERRULE—supersede, suppress.
OVERSPREAD—overrun, ravage.
OVERTURN—invert, overthrow, reverse, subvert. (Establish, fortify.)
OVERWHELM—crush, defeat, vanquish.

PAIN—suffering, qualm, pang, agony, anquish. (Pleasure.)
PALLID—pale, wan. (Florid.)
PART—division, portion, share, fraction. (Whole.)
PARTICULAR—exact, distinct, singular, strange, odd. (General.)
PATIENT—passive, submissive. (Obdurate.)
PEACE—calm, quiet, tranquility. (War, trouble, riot, turbulence.)
PEACEABLE—pacific, peaceful, quiet. (Troublesome, riotous.)
PENETRATE—bore, pierce, perforate.
PENETRATION—acuteness, sagacity. (Dullness.)
PEOPLE—nation, persons, folks.
PERCEIVE—note, observe, discern, distinguish.
PERCEPTION—conception, notion, idea.
PERIL—danger, pitfall, snare. (Safety.)
PERMIT—allow, tolerate. (Forbid.)
PERSUADE—allure, entice, prevail upon.
PHYSICAL—corporeal, bodily, material. (Mental.)
PICTURE—engraving, print, representation, illustration, image.
PITEOUS—doleful, woeful, rueful. (Joyful.)
PITILESS—see merciless.
PITY—compassion, sympathy. (Cruelty.)
PLACE, *n.*—spot, site, position, post, situation.
PLACE, *v.*—order, dispose.
PLAIN—open, manifest, evident. (Secret.)
PLAY—game, sport, amusement. (Work.)
PLEASE—gratify, pacify. (Displease.)
PLEASURE—charm, delight, joy. (Pain.)
PLENTIFUL—abundant, ample, copious, plenteous. (Scarce.)

POISE—balance, equilibrium, evenness.

POSITIVE—absolute, peremptory, decided, certain. (Negative, undecided.)

POSSESSOR—owner, proprietor.

POSSIBLE—practical, practicable. (Impossible.)

POVERTY—penury, indigence, need. (Wealth.)

POWER—authority, force, strength, dominion.

POWERFUL—mighty, potent. (Weak.)

PRAISE—commend, extol, laud. (Blame.)

PRAYER—entreaty, petition, request, suit.

PRETENCE, *n.*—pretext, subterfuge.

PREVAILING—predominant, prevalent, general. (Isolated, sporadic.)

PREVENT—obviate, preclude.

PREVIOUS—antecedent, introductory, preparatory, preliminary. (Subsequent.)

PRIDE—vanity, conceit. (Humility.)

PRINCIPALLY—chiefly, essentially, mainly.

PRINCIPLE—ground, reason, motive, impulse, maxim, rule, rectitude, integrity.

PRIVILEGE—immunity, advantage, favor, claim, prerogative, exemption, right.

PROBITY—rectitude, uprightness, honesty, integrity, sincerity, soundness. (Dishonesty.)

PROBLEMATICAL—uncertain, doubtful, dubious, questionable, disputable, suspicious. (Certain.)

PRODIGIOUS—huge, enormous, vast, amazing, astonishing, astounding, surprising, remarkable, wonderful. (Insignificant.)

PROFESSION—business, trade, occupation, office, vocation, employment, engagement, avowal.

PROFFER—volunteer, offer, propose, tender.

PROFLIGATE—abandoned, dissolute, depraved, vicious, degenerate, corrupt. (Virtuous.)

PROFOUND—deep, fathomless, penetrating, recondite, solemn, abstruse. (Shallow.)

PROFUSE—extravagant, prodigal, lavish, copious, improvident, excessive, plentiful. (Succinct.)

PROLIFIC—productive, generative, fertile, fruitful, teeming. (Barren.)

PROLIX—diffuse, long, prolonged, tedious, wordy, tiresome, verbose, prosaic. (Concise, brief.)

PROMINENT—eminent, conspicuous, marked, important, leading. (Obscure.)

PROMISCUOUS—mixed, unarranged, mingled, indiscriminate. (Select.)

PROMPT—See punctual.

PROP, *v.*—maintain, sustain, support, stay.

PROPAGATE—spread, circulate, diffuse, disseminate, extend, breed, increase. (Suppress.)

PROPER—legitimate, right, just, fair, equitable, honest, suitable, fit, adapted, meet, becoming, befitting, decent, pertinent. (Wrong.)

PROSPER—flourish, succeed, grow rich, thrive, advance. (Fail.)

PROSPERITY—well-being, weal, welfare, happiness, good luck. (Poverty.)

PROXY—agent, representative, substitute, deputy.

PRUDENCE—carefulness, judgment, discretion, wisdom. (Indiscretion.)

PRURIENT—itching, craving, hankering, longing.

PUERILE—youthful, juvenile, boyish, childish, infantile, trifling, weak, silly. (Mature.)

PUNCTILIOUS—nice, particular, formal, precise. (Negligent.)

PUNCTUAL—exact, precise, nice, particular, prompt, timely. (Dilatory.)

PUTREFY—rot, decompose, corrupt, decay.

PUZZLE, *v.*—preplex, confound, embarrass, pose, bewilder, confuse, mystify. (Enlighten.)

QUACK—imposter, pretender, charlatan, empiric, mountebank. (Savant.)

QUAINT—artful, curious, far-fetched, fanciful, odd.

QUALIFIED—competent, fitted. (Incompetent.)

QUALITY—attribute, rank, distinction.

QUERULOUS—doubting, complaining, fretting, repining. (Patient.)

QUESTION—query, inquiry, interrogatory.

QUIBBLE—cavil, evade, equivocate, shuffle.

QUICK—lively, ready, prompt, alert, nimble, agile, active, brisk, expeditious, adroit, fleet, rapid, impetuous, swift, sweeping, dashing, clever. (Slow.)

QUOTE—note, repeat, cite, adduce.

RABID—mad, furious, raging, frantic. (Rational.)

RACE—course, match, pursuit, career, family, clan, house, ancestry, lineage, pedigree.

RACK—agonize, wring, torture, excruciate, harass, distress. (Soothe.)

RACY—spicy, pungent, smart, spirited, vivacious, lively. (Dull, insipid.)

RADIANCE—splendor, brightness, brilliance, brilliancy, lustre, glare. (Dullness.)

RADICAL—organic, innate, fundamental, original, constitutional, inherent, complete, entire. (Superficial. In a political sense, uncompromising: antonym, moderate.)

RANCID—fetid, rank, stinking, sour, tainted, foul. (Fresh, sweet.)

RANCOR—malignity, hatred, hostility, antipathy, animosity, enmity, ill-will, spite. (Forgiveness.)

RANK—order, degree, dignity, consideration.

RANSACK—rummage, pillage, overhaul, explore.

RANSOM—emancipate, free, unfetter.

RANT—bombast, fustian, cant.

RAPACIOUS—ravenous, voracious, greedy, grasping. (Generous.)

RAPT—ecstatic, transported, ravished, entranced, charmed. (Distracted.)

RAPTURE—ecstacy, transport, bliss. (Dejection.)

RARE—scarce, singular, uncommon, unique.

RASCAL—scoundrel, rogue, knave, vagabond.

RASH—hasty, precipitate, foolhardy, adventurous, heedless, reckless, careless. (Deliberate.)

RATE—value, compute, appraise, estimate, abuse.

RATIFY—confirm, establish, substantiate, sanction. (Protest, oppose.)

RATIONAL—reasonable, sagacious, judicious, wise, sensible, sound. (Unreasonable.)

RAVAGE—overrun, overspread, desolate, despoil.

RAVISH—enrapture, enchant, charm, delight.

RAZE—demolish, destroy, overthrow, dismantle, ruin. (Build up.)

REACH—touch, stretch, attain, gain, arrive at.

READY—prepared, ripe, apt, prompt, adroit, handy. (Slow, dilatory.)

REAL—actual, literal, practical, positive, certain, genuine, true. (Unreal.)

REALIZE—accomplish, achieve, effect, gain, get, acquire, comprehend.

REAP—gain, get, acquire, obtain.

REASON, *n.*—motive, design, end, proof, cause, ground, purpose.

REASON, *v.*—deduce, draw from, trace, conclude.

REASONABLE—rational, wise, honest, fair, right, just. (Unreasonable.)

REBELLION—insurrection, revolt.

RECANT—recall, abjure, retract, revoke.

RECEDE—retire, retreat, withdraw, ebb.

RECEIVE—accept, take, admit, entertain.

RECEPTION—receiving, levee, receipt, admission.

RECESS—retreat, depth, niche, vacation.

RECREATION—sport, pastime, play, amusement, game, fun.

REDEEM—ransom, recover, rescue, deliver, save.

REDRESS—remedy, repair, remission, abatement.

REDUCE—abate, lessen, decrease, lower, shorten.

REFINED—polite, courtly, polished, cultured, purified, genteel. (Boorish.)

REFLECT—consider, cogitate, think, muse, censure.

REFORM—amend, correct, better, restore, improve. (Corrupt.)

REFORMATION—improvement, reform, amendment. (Corruption.)

REFUGE—asylum, protection, harbor, shelter.

REFUSE, *v.*—deny, reject, repudiate, decline, withhold. (Accept.)

REFUSE, *n.*—dregs, dross, scum, rubbish, leavings.

REFUTE—disprove, falsify, negative. (Affirm.)

REGARD, *v.*—mind, heed, notice, behold, respect, view, consider.

REGRET, *n.*—grief, sorrow, lamentation, remorse.

REGULAR—orderly, uniform customary, ordinary, stated. (Irregular.)

REGULATE—methodize, arrange, adjust, organize, govern, rule. (Disorder.)

REIMBURSE—refund, repay, satisfy, indemnify.

RELEVANT—fit, proper, suitable, appropriate, apt, pertinent. (Irrelevant.)

RELIANCE—trust, hope, dependence, confidence. (Suspicion.)

RELIEF—succor, aid, help, redress, alleviation.

RELINQUISH—give up, forsake, resign, surrender, quit, leave, forego. (Retain.)

REMEDY—help, relief, redress, cure, specific.

REMORSELESS—pitiless, relentless, cruel, ruthless, merciless, barbarous. (Merciful, humane.)

REMOTE—distant, far, secluded, indirect. (Near.)

REPRODUCE—propagate, imitate, represent, copy.

REPUDIATE—disown, discard, disavow, renounce, disclaim. (Acknowledge.)

REPUGNANT—antagonistic, distasteful. (Agreeable.)

REPULSIVE—forbidding, odious, ugly, disagreeable, revolting. (Attractive.)

RESPITE—reprieve, interval, stop, pause.

REVENGE—vengeance, retaliation, requital, retribution. (Forgiveness.)

REVENUE—produce, income, fruits, proceeds.

REVERENCE, *n.*—honor, respect, awe, veneration, deference, worship, homage. (Execration.)

REVISE—review, reconsider.

REVIVE—refresh, renew, renovate, animate, resuscitate, vivify, cheer, comfort.

RICH—wealthy, affluent, opulent, copious, ample, abundant, exuberant, plentiful, fertile, gorgeous, superb, fruitful. (Poor.)

RIVAL, *n.*—antagonist, opponent, competitor.

ROAD—way, highway, route, course, path, pathway, anchorage.

ROAM—ramble, rove, wander, stray, stroll.

ROBUST—strong, lusty, vigorous, sinewy, stalwart, stout, sturdy, able-bodied. (Puny.)

ROUT, *v.*—discomfit, beat, defeat, overthrow.

ROUTE—road, course, march, way, journey, path.

RUDE—rugged, rough, uncouth, unpolished, harsh. gruff, impertinent, saucy, flippant, impudent, insolent, saucy, churlish. (Polite, polished.)

RULE—sway, method, system, law, maxim, guide. precept, formula, regulation, government, test, standard.

RUMOR—hearsay, talk, fame, report, bruit.

RUTHLESS—cruel, savage, barbarous, inhuman, merciless, remorseless, relentless. (Considerate.)

SACRED—holy, hallowed, divine, consecrated, dedicated, devoted. (Profane.)

SAFE—secure, harmless, trustworthy. (Perilous.)

SANCTION—confirm, countenance, encourage, support, ratify, authorize. (Disapprove.)

SANE—sober, lucid, sound, rational. (Crazy.)

SAUCY—impertinent, rude, impudent, insolent, flippant, forward. (Modest.)

SCANDALIZE—shock, disgust, offend, calumniate, vilify, revile, malign, traduce, defame, slander.

SCANTY—bare, pinched, insufficient, slender, meager. (Ample.)

SCATTER—strew, spread, disseminate, disperse, dissipate, dispel. (Collect.)

SECRET—clandestine, concealed, hidden, sly, underhand, latent, private. (Open.)

SEDUCE—allure, attract, decoy, entice, abduct, inveigle, deprave.

SENSE—discernment, appreciation, view, opinion, feeling, perception, sensibility, susceptibility, significance, thought, judgment, signification, meaning, import, purport, wisdom.

SENSIBLE—wise, intelligent, reasonable, sober, sound, conscious, aware. (Foolish.)

SETTLE—arrange, adjust, regulate, conclude.

SEVERAL—sundry, divers, various, many.

SEVERE—harsh, stern, stringent, unmitigated, unyielding, rough. (Lenient.)

SHAKE—tremble, shudder, shiver, quake, quiver.

SHALLOW — superficial, flimsy, slight. (Deep, thorough.)

SHAME—disgrace, dishonor. (Honor.)

SHAMEFUL—degrading, scandalous, disgraceful, outrageous. (Honorable.)

SHAMELESS—immodest, impudent, indecent, indelicate, brazen.

SHAPE—form, fashion, mold, model.

SHARE—portion, lot, division, quantity, quota.

SHARP—acute, keen. (Dull.)

SHINE—glare, glitter, radiate, sparkle.

SHORT—brief, concise, succinct, summary. (Long.)

SHOW, *n.*—exhibition, sight, spectacle.

SICK—diseased, sickly, unhealthy. (Healthy.)

SICKNESS—illness, indisposition, disease, disorder. (Health.)

SIGNIFICANT, *a.*—expressive, material, important. (Insignificant.)

SIGNIFICATION—import, meaning, sense.

SILENCE—speechlessness, dumbness. (Noise.)

SILENT—dumb, mute, speechless. (Talkative.)

SIMILE—comparison, similitude.

SIMPLE—single, uncompounded, artless, plain. (Complex, compound.)

SIMULATE—dissimulate, dissemble, pretend.

SINCERE—candid, hearty, honest, pure, genuine, real. (Insincere.)

SITUATION—condition, plight, predicament, state.

SIZE—bulk, greatness, magnitude, dimension.

SLAVERY — servitude, enthrallment, thralldom. (Freedom.)

SLEEP—doze, drowse, nap, slumber.

SLEEPY—somnolent. (Wakeful.)

SLOW—dilatory, tardy. (Fast.)

SMELL—fragrance, odor, perfume, scent.

SMOOTH—even, level, mild. (Rough.)

SOAK—drench, imbrue, steep.

SOCIAL—sociable, friendly, communicative. (Unsocial.)

SOFT—gentle, meek, mild. (Hard.)

SOLICIT—importune, urge.

SOLITARY—sole, only, single.

SORRY—grieved, poor, paltry, insignificant. (Glad, respectable.)

SOUL—mind, spirit. (Soul is opposed to body, mind to matter.)

SOUND, *a.*—healthy, sane. (Unsound)

SOUND, *n.*—tone, noise, silence.

SPACE—room.

SPARSE—scanty, thin. (Luxuriant.)

SPEAK—converse, talk, confer, say, tell.

SPECIAL—particular, specific. (General.)

SPEND—expend, exhaust, consume, waste, dissipate. (Save.)

SPORADIC—isolated, rare. (General, prevalent.)

SPREAD—disperse, diffuse, expand, disseminate.

SPRING—fountain, source.

STAFF—prop, support, stay.

STAGGER—reel, totter.

STAIN—soil, discolor, spot, sully, tarnish.

STATE—commonwealth, realm.

STERILE—barren, unfruitful. (Fertile.)

STIFLE—choke, suffocate, smother.

STORMY—rough, boisterous, tempestuous. (Calm.)

STRAIGHT—direct, right. (Crooked.)

STRAIT, *a.*—narrow, confined.

STRANGER—alien, foreigner. (Friend.)

STRENGTHEN—fortify, invigorate. (Weaken.)

STRONG—robust, sturdy, powerful. (Weak.)

STUPID—dull, foolish, obtuse, witless. (Clever.)

SUBJECT—exposed to, liable, obnoxious. (Exempt.)

SUBJECT — inferior, suborbinate. (Superior to, above.)

SUBSEQUENT—succeeding, following. (Previous.)

SUBSTANTIAL—solid, durable. (Unsubstantial.)

SUIT—accord, agree. (Disagree.)

SUPERFICIAL—flimsy, shallow, untrustworthy (Thorough.)

SUPERFLUOUS—unnecessary. (Necessary.)

SURROUND—encircle, encompass, environ.

SUSTAIN—maintain, support.

SYMMETRY—proportion

SYMPATHY—commiseration, compassion.

SYSTEM—method, plan, order.

SYSTEMATIC — orderly, regular, methodical. (Chaotic.)

TAKE—accept, receive. (Give.)

TALKATIVE—garrulous, loquacious, communicative. (Silent.)

TASTE—flavor, relish, savor. (Tastelessness.)

TAX—custom, duty, impost, excise, toll.

TAX—assessment, rate.

TEASE—taunt, tantalize, torment, vex.

TEMPORARY, *a.*—fleeting, transient, transitory. (Permanent.)

TENACIOUS—pertinacious, retentive.

TENDENCY—aim, drift, scope.

TENET—position, view, conviction, belief.

TERM—boundary, limit, period, time.

TERRITORY—dominion.

THANKFUL—grateful, obliged. (Thankless.)

THANKLESS—ungracious, profitless, ungrateful unthankful.

THAW—melt, dissolve, liquefy. (Freeze.)

THEATRICAL—dramatic, showy, ceremonious.

THEFT—robbery, depredation, spoliation.

THEME—subject, topic, text, essay.

THEORY—speculation, scheme, plea, hypothesis, conjecture.

THEREFORE—accordingly, consequently, hence.

THICK—dense, close, compact, solid, coagulated, muddy, turbid, misty, vaporous. (Thin.)

THIN—slim, slender, slight, flimsy, lean, scraggy, attenuated.

THINK—cogitate, consider, reflect, ponder, muse, contemplate, meditate, conceive, fancy, imagine, apprehend, hold, esteem, reckon, consider, deem, regard, believe, opine.

THOROUGH—accurate, correct, trustworthy, complete, reliable. (Superficial.)

THOUGHT—idea, conception, imagination, fancy, conceit, notion, supposition, care, provision, consideration, opinion, view, sentiment, reflection, deliberation.

THOUGHTFUL—considerate, careful, cautious, heedful, contemplative, reflective, provident, pensive, dreamy. (Thoughtless.)

THOUGHTLESS—inconsiderate, rash, precipitate, improvident, heedless.

TIE, *v.*—bind, restrain, restrict, oblige, secure, join, unite. (Loose.)

TIME—duration, season, period, era, age, date, span, spell.

TOLERATE—allow, admit, receive, suffer, permit, let, endure, abide. (Oppose.)

TOP—summit, apex, head, crown, surface. (Base, bottom.)

TORRID—burning, hot, parching, scorching.

TORTUOUS—twisted, winding, crooked, indirect.

TORTURE—torment, anguish, agony.

TOUCHING—tender, affecting, moving, pathetic.

TRACTABLE—docile, manageable, amenable.

TRADE—traffic, commerce, dealing, occupation, employment, office.

TRADITIONAL—oral, uncertain, transmitted.

TRAFFIC—trade, exchange, commerce.

TRAMMEL, *n.*—fetter, shatter, clog, bond, impediment, chain, hindrance.

TRANQUIL—still, unruffled, peaceful, hushed, quiet. (Noisy, boisterous.)

TRANSACTION—negotiation, occurrence, proceeding, affair.

TRAVEL—trip, peregrination, excursion, journey, tour, voyage.

TREACHEROUS—traitorous, disloyal, treasonable, faithless, false-hearted. (Trustworthy, faithful.)

TRITE—stale, old, ordinary, commonplace, hackneyed. (Novel.)

TRIUMPH—achievement, ovation, victory, jubilation, conquest. (Failure, defeat.)

TRIVIAL—trifling, petty, small, frivolous, unimportant, insignificant. (Important.)

TRUE—genuine, actual, sincere, unaffected, true-hearted, honest, upright, veritable, real, veracious, authentic, exact, accurate, correct.

TUMULTUOUS—turbulent, riotous, disorderly, disturbed, confused, unruly. (Orderly.)

TURBID—foul, thick, muddy, impure, unsettled.

TYPE—emblem, symbol, figure, sign, kind, letter.

TYRO—novice, beginner, learner.

UGLY—unsightly, plain, homely, ill-favored, hideous. (Beautiful.)

UMBRAGE—offense, dissatisfaction, resentment.

UMPIRE—referee, arbitrator, judge, arbiter.

UNANIMITY—accord, agreement, unity, concord. (Discord.)

UNBRIDLED—wanton, licentious, dissolute, loose.

UNCERTAIN—doubtful, dubious, questionable, fitful, equivocal, ambiguous, indistinct, fluctuating.

UNCIVIL—rude, discourteous, disrespectful, disobliging. (Civil.)

UNCLEAN—dirty, foul, filthy, sullied. (Clean.)

UNCOMMON—rare, strange, scarce, singular, choice. (Common, ordinary.)

UNCONCERNED—careless, indifferent, apathetic. (Anxious.)

UNCOUTH—strange, odd, clumsy. (Graceful.)

UNCOVER—reveal, strip, expose, lay bare. (Hide.)

UNDER—below, underneath, beneath, subordinate, lower, inferior. (Above.)

UNDERSTANDING—knowledge, intellect, intelligence, faculty, comprehension, mind, reason.

UNDO—annul, frustrate, untie, unfasten, destroy.

UNEASY—restless, disturbed, unquiet, awkward, stiff. (Quiet.)

UNEQUAL—uneven, not alike, irregular. (Even.)

UNEQUALED—matchless, unique, novel, new.

UNFIT, *a.*—improper, unsuitable, inconsistent, untimely, incompetent. (Fit.)

UNFIT, *v.*—disable, incapacitate, disqualify. (Fit.)

UNFORTUNATE—calamitous, ill-fated, unlucky, wretched, unhappy, miserable. (Fortunate.)

UNGAINLY—clumsy, awkward, lumbering, uncouth. (Pretty.)

UNHAPPY—miserable, wretched, distressed, painful, afflicted, disastrous, drear, dismal. (Happy.)

UNIFORM—regular, symmetrical, equal, even, alike, unvaried. (Irregular.)

UNINTERRUPTED—continuous, perpetual, unceasing, incessant, endless. (Intermittent.)

UNION—junction, combination, alliance, confederacy, league, coalition, agreement. (Disunion.)

UNIQUE—unequal, uncommon, rare, choice, matchless. (Common, ordinary.)

UNITE—join, conjoin, combine, concert, add, attach (Separate, disrupt, sunder.)

UNIVERSAL—general, all, entire, total, catholic. (Sectional.)

UNLIMITED—absolute, undefined, boundless, infinite. (Limited.)

UNREASONABLE—foolish, silly, absurd, preposterous, ridiculous.

UNRIVALED—unequaled, unique, unexampled, incomparable, matchless. (Mediocre.)

UNRULY—ungovernable, unmanageable, refractory. (Tractable, docile.)

UNUSUAL—rare, unwonted, singular, uncommon, remarkable, strange. (Common.)

UPHOLD—maintain, defend, sustain, support, indicate. (Desert, abandon.)

UPRIGHT — vertical, perpendicular, erect, just, equitable, fair, pure, honorable. (Prone.)

UPRIGHTNESS—honesty, integrity, fairness, goodness, probity, virtue, honor. (Dishonesty.)

URGE—incite, impel, push, drive, instigate, stimulate, press, induce, solicit.

URGENT—pressing, imperative, immediate, serious, wanted. (Unimportant.)

USAGE—custom, fashion, practice, prescription.

USE, *n.* — usage, practice, habit, custom, avail, advantage, utility, benefit, application. (Disuse.)

USUAL—ordinary, common, accustomed, habitual, wonted, customary, general. (Unusual.)

UTMOST—farthest, remotest, uttermost, greatest.

UTTER, *a.*—extreme, excessive, sheer, mere, pure.

UTTER, *v.*—speak, articulate, pronounce, express.

UTTERLY—totally, completely, wholly, altogether.

VACANT—empty, unfilled, unoccupied, thoughtless, unthinking. (Occupied.)

VAGRANT, *n.*—wanderer, beggar, tramp, rogue.

VAGUE—unsettled, undetermined, pointless, uncertain, indefinite. (Definite.)

VAIN—useless, fruitless, empty, worthless, inflated, proud, conceited, unreal. (Effectual, humble.)

VALIANT—brave, bold, valorous, courageous, gallant. (Cowardly.)

VALID—weighty, strong, powerful, sound, binding, efficient. (Invalid.)

VALOR — courage, gallantry, boldness, bravery, heroism. (Cowardice.)

VALUE, *v.*—appraise, assess, reckon, appreciate, estimate, prize, esteem, treasure. (Despise,)

VARIABLE — changeable, unsteady, inconstant, shifting, wavering, fickle, restless. (Constant.)

VARIETY—difference, diversity, change, diversification, mixture, medley, miscellany. (Sameness, monotony.)

VAST—spacious, boundless, mighty, enormous, immense, colossal, gigantic, prodigious. (Confined.)

VAUNT—boast, brag, puff, hawk, advertise, parade.

VENERABLE—grave, sage, wise, old, reverend.

VENIAL—pardonable, excusable, justifiable. (Serious, grave.)

VENOM—poison, virus, spite, malice, malignity.

VENTURE, *n.*—speculation, chance, peril, stake.

VERACITY—truth, truthfulness, credibility, accuracy. (Falsehood.)

VERBAL—oral, spoken, literal, parole, unwritten.

VERDICT—judgment, finding, decision, answer.

VEXATION—chagrin, mortification. (Pleasure.)

VIBRATE—oscillate, swing, sway, wave, thrill.

VICE—vileness, corruption, depravity, pollution, immorality, wickedness, guilt, iniquity. (Virtue.)

VICIOUS—corrupt, depraved, debased, bad, unruly, contrary, demoralized, profligate, faulty. (Gentle, virtuous.)

VICTIM—sacrifice, food, prey, sufferer, dupe, gull.

VICTUALS—viands, bread, meat, provisions, fare, food, repast.

VIOLENT—boisterous, furious, impetuous, vehement. (Gentle.)

VIRTUOUS—upright, honest, moral. (Profligate.)

VISION—apparition, ghost, phantom, specter.

VOLUPTUARY—epicure, sensualist.

VOUCH—affirm, asserverate, assure, aver.

WAIT—await, expect, look for, wait for.

WAKEFUL—vigilant, watchful. (Sleepy.)

WANDER—range, ramble, roam, rove, stroll.

WANT—lack, need. (Abundance.)

WARY—circumspect, cautious. (Foolhardy.)

WASH—clean, rinse, wet, moisten, stain, tint.

WASTE, *v.*—squander, dissipate, lavish, destroy, decay, dwindle, wither.

WAY—method, plan, system, means, manner, mode, form, fashion, course, process, road, route, track, path, habit, practice.

WEAKEN—debilitate, enfeeble, enervate, invalidate. (Strengthen.)

WEARY—harass, jade, tire, fatigue. (Refresh.)

WEIGHT — gravity, heaviness, burden, load. (Lightness.)

WELL-BEING—happiness, prosperity, welfare.

WHOLE—entire, complete, total, integral. (Part.)

WICKED—iniquitous, nefarious. (Virtuous.)

WILL—wish, desire.

WILLINGLY—spontaneously, voluntarily. (Unwillingly.)

WIN—get, obtain, gain, procure, effect, realize, accomplish, achieve. (Lose.)

WINNING—attractive, charming, fascinating, bewitching, enchanting, dazzling. (Repulsive.)

WISDOM — prudence, foresight, far-sightedness, sagacity. (Foolishness.)

WONDER, *v.*—admire, amaze, astonish, surprise.

WONDER, *n.*—marvel, miracle, prodigy.

WRONG—injustice, injury. (Right.)

YAWN—gape, open wide.

YEARN—hanker after, long for, desire, crave.

YELL—bellow, cry out, scream.

YELLOW—golden, saffron-like.

YELP—bark, sharp cry, howl.

YET—besides, nevertheless, notwithstanding, however, still, ultimately, at last, so far, thus far.

YIELD—bear, give, afford, impart, communicate, confer, bestow, abdicate, resign, cede, surrender.

YIELDING—supple, pliant, bending, compliant, submissive, unresisting. (Obstinate.)

YOKE, *v.*—couple, link, connect.

YORE—long ago, long since.

YOUTH—boy, lad, minority, adolescence.

YOUTHFUL—juvenile, puerile. (Old.)

ZEAL—energy, fervor, ardor, earnestness, enthusiam, eagerness. (Indifference.)

ZEALOUS—warm, ardent, fervent, enthusiastic, anxious. (Indifferent, careless.)

ZEST—relish, gusto, flavor. (Disgust.)

The Government to Tell You What Your Farm Will Grow

WONDERFUL things are being done by the Agricultural Department at Washington.

Its scientists are learning all about the underground "climate" of every acre of land in the country. Also they are studying exactly how plant roots are affected by particular conditions of this climate.

They will make a great map to show the nature of soil in every nook and corner of the United States. This wonderful map will cover the entire country, but it will be divided into a great many parts, so that every owner of a ten-acre tract may procure a chart of his own immediate neighborhood and thus determine just where his fortune lies hidden.

New Products for Old Soil.

The interesting feature of the whole thing is that there are many property owners who will discover when this work is completed that their greatest chance for wealth lies in cultivation of products which have never heretofore been grown in their part of the continent.

The peculiar characteristics of many varieties of soil on the globe may be traced directly to what might be termed the climatic conditions. It does not appear to have occurred to many persons, even among expert farmers and horticulturists, that the temperature and the amount of moisture present underground are quite as important in their influence as are the corresponding factors on the surface of the earth, and yet it is all so palpably evident now that Uncle Sam's wise men have started in to officially exploit the matter. The experiments which they have already undertaken prove how intimate is the relationship between influences above and below ground.

Effects of High Temperature.

A high temperature in the soil under favorable conditions promotes extensive root development, whereas a high temperature in the atmosphere above the soil will, under equally favorable circumstances, favor a heavy growth of foliage. A deficiency in the water supply either in the air or soil is attended with distress to the plant.

Primarily the exploration which Uncle Sam has inaugurated consists in separating the soil into groups and then determining the distinctive traits of each group.

Perhaps the most striking example is found in the recent discovery relative to tobacco culture in the Connecticut Valley. An inquisitive government scientist a few months ago observed that certain soil areas in the Connecticut Valley were practically identical in character with those in Florida, upon which the finest cigar wrappers are being grown from Sumatra seed.

Prospective tobacco planters went to work and if the extensive experiments now in progress confirm the verdict of the earlier ones

it looks as though there would be grown in New England the cigar wrappers for which American manufacturers are now paying $6,000,000 annually to foreign merchants.

Necessity for Moisture.

The absolute dependence of all members of the plant world upon a proper supply of moisture is so apparant that the soil explorers naturally took up this phase of the subject first and gave it considerable attention. The simplest method of ascertaining the proportion of moisture is to weigh a moist sample of the soil and then, after drying it thoroughly, weigh again and compute the loss in weight. When a large number of moisture determinations had to be made, the officials of the division of soils of the national capital devised an electrical method. This scheme is based on the principle that the resistance offered to the passage of an electric current through the ground depends upon the amount of moisture in the soil, and there has been provided an ingenious instrument for measuring the resistance and thereby giving the information desired.

In the government soil studies the wires of this strange form of telephone, which is to bring reports of the condition of the soil, are buried in the ground at the beginning of the season, and remain undisturbed throughout the year, so that the record obtained shows the variations under all sorts of conditions. The temperature of soils, it has been discovered, may be determined just as accurately, as highly interesting disclosures have been made in consequence. For instance, the temperature investigations have shown that the warmth of the soil in the early spring may be increased by drainage, and that the temperature of soils in midsummer can be somewhat reduced by an efficient dust mulch, which is not a good heat conductor. Shade trees have been proved to have almost as cooling an influence upon the soil as they exert upon human beings.

Simultaneously with this soil exploration there has been conducted under government supervision at the Dakota Experiment Station some very important studies of root systems. The great difficulty in this work has been to succeed in uncovering the roots of plants without destroying them. And here once more American inventive skill came to the rescue.

How Plants are Studied.

Mr. A. M. Ten Eyck, one of the experts at the Dakota Station, hit upon the plan of transferring the plant to be studied, together with a portion of the earth surrounding it, to a wooden frame in the shape of a box, covered with ordinary wire netting, such as is used in poultry yards. The mass of soil was then pierced through and through with fine wire rods, and when all the earth was washed away these diminutive wire beams held the roots quite as delicately as the soil had done, and yet left every thread-like root exposed on all sides to the gaze of the investigators.

These two lines of governmental investigation, taken in conjunction, are bound to revolutionize many branches of farming and gardening.

For instance, the root study will demonstrate the amount of moisture and other nutriment which each class of plants needs, whereas the soil exploration will disclose where the natural conditions are most nearly ideal for such growth. This knowledge will enable the farmer and the truck gardener to determine what class of growing things he should cultivate in order to reap the richest harvest.

THE RAILWAY LOOP

Invention by which Cars are Whirled Around Vertically without Dropping Passengers

SOME natural philosopher remembered his boyhood experiments in swinging a pail of water over his head without spilling a drop, and argued that human beings put in a car could be treated in the same way. He was right, for that is the principal of the flip-flap railway. The centrifugal force keeps the passengers from falling down and breaking their necks, although they are seated in a car that dashes around a vertical loop and at its top are actually riding upside down.

How it is Constructed.

The car runs on a single rail with an upper and under set of wheels; traveling on the under set while it is inverted and back again on the upper set after the turn is made. The flip-flap generally has a loop about 40 feet high. There are two tracks, so that a double set of cars can be run. The car is carried by an endless chain to an elevation as high as the top of the loop and then sent down a steep incline, so that it strikes the upstretch of the loop with a terrific momentum that carries it clear over.

When the first flip-flap was built there was no rush to be the first passenger. It was considered an even chance that he would fall out. So a bag of sand was put in and the car started off. Sure enough it did fall out.

Some ballasting was done, and they tried it again, with a bigger bag of sand. The second bag made the journey safely, and there was rejoicing among the owners. Then a dog was given a free ride, much to his surprise and disgust. He had no inclination to bark and left the neighborhood hot-footed immediately after.

Still there was no clamor for the honor of the first ride. The owners offered to give $50 to the first person to try it. Finally a workman said if they would make it $60 he would go. They did, and he made the trip unharmed, save for a thorough scare. It took about a minute. He said he considered one dollar a second fair pay.

Defies Gravitation.

The following is an account of this curious contrivance by a lady who ventured to try it:

"I have defied the laws of gravitation. I shot around a huge loop in a car and when it was upside down I didn't fall out.

"I was projected through space at the rate of ninety-five miles an hour and have won out in one minute and sixteen seconds, which is a pretty good record for even a girl of the twentieth century. The other morning I sat for hours watching that dreadful monster, the 'flip-flap,' that makes one almost think of a guillotine awaiting its victims, and trembled in my boots every time a carload approached the dreaded 'loop' and closed my eyes, expecting to hear their terrified shrieks as they neared their doom

When I opened my eyes again the jaunty little car would be half way on the home-stretch, and its occupants smiling and happy, but just a trifle pale.

"I learned afterward, by experience, that it is impossible to utter a cry or a sound, the momentum with which the car swings around the 'loop' being so great one has no breath to utter a word. I had been 'dared' to take a ride on the flip-flap railway, and I had determined to do it, but at the first sight of that awful, gaunt structure I felt my nerve gradually deserting me.

"'Open your eyes!' roared the captain, and I obeyed orders—in time to see something that appeared to be a terrible obstruction in our pathway. I hadn't time to think of it again, for I felt a sudden twist, and unconsciously ducked my head.

"'You must go around once more,' said the captain, 'and keep your eyes open all the time.' I promised faithfully. This time we were going to break the record. It was a regular 'first night' audience that watched the captain and me on our numerous trips, and I saw two old ladies looking at me with horrified disapproval.

"We were all happy on the third trip. We even laughed and conversed on the brink of that awful, yawning incline."



VERTICAL LOOP AND CAR WHIRLING PASSENGERS UPSIDE DOWN.

THREE FAMOUS INVENTORS
AND
THEIR PHENOMENAL DISCOVERIES

MARCONI TRANSMITS MESSAGES HUNDREDS OF MILES BY ELECTRICITY WITHOUT WIRES—SANTOS-DUMONT'S AIR-SHIP NAVIGATES THE AIR—AND JOHN P. HOLLAND SOLVES THE PROBLEM OF SUBMARINE NAVIGATION.

Three amazing achievements have proved that the age of wonders—we had almost said miracles—has not ceased. Problems that were thought to be incapable of solution have yielded to the conquering genius of the world's renowned and scientific discoverers, and what was once thought to be visionary and impossible, has been accomplished.

A world-wide interest—one might say even astonishment—has been created by the discoveries of Marconi, whereby he is able to transmit messages without the aid of wires. This may well be called a miracle of science and invention. When Morse, Edison and Bell electrified the public with their marvelous achievements, it was not guessed by the wildest dreamer, that any greater and more phenomenal discoveries could ever be expected. Now, time and space seem to have been annihilated, and we have an electrical discovery that must rank as one of the greatest wonders of modern times.

Wireless telegraphy is the transmission of electric telegraphic signals through space without the use of any wires that run directly from the transmitting to the receiving instrument. Marconi's apparatus, the first to prove a practical success, makes use of what are known as the Hertzian waves.

These electric waves, first discovered by Heinrich Hertz, pass through space with the velocity of light and are generated at the transmitting point by a battery and intensity coil sending a current between two and sometimes four large brass knobs. The usual current in passing makes a six-inch spark, and the more powerful the current the further the wave will be generated in all directions.

The wave is detected at the receiving point by a device known as a "coherer," which consists of fine metal filings of nickel and silver placed upon strips of copper or brass. The wave generated at the transmitted point, when it reaches the receiver or "coherer," sets up electric oscillations in the metal filings and by throwing off and on the current at the transmitting point the Morse telegraphic or other signals are indicated upon said filings at the receiver.

Various features of the apparatus used may be varied, but the main principle now relied upon is that of the Hertzian wave. What is known as the induction method employs heavily charged coils of wire at both the transmitting and receiving points. This

can hardly be called "wireless" telegraphy, however, and has not yet proved as successful as Marconi's apparatus.

In September, 1901, Marconi came to America to report by wireless telegraphy the international yacht race. Upon his arrival he made the following statement:

"We will be able to send the details of the racing to New York as accurately and as quickly almost as if you could telephone them," he said. "The distance involved is nothing, nor will hills or buildings interfere with the communication. In our experiments carried on in England we sent messages over much greater distances than we have to contend with in this case. I have conducted many tests from moving vessels to stationary and moving receiving points with complete satisfaction.

Messages on Ship Board.

"The most remarkable, perhaps, were made during the recent British naval manœuvres. The Admiralty is very deeply interested in the subject and asked me to install my system on board three ships of the fleet that was engaged in defending the coasts of England. The scouting cruiser Juno and the flagship Alexandra were two of three equipped. I was on board the flagship, and during the cruise I did not get much sleep. The scouts were directed to report every vessel sighted, send description of her, which direction she was steering and everything about her.

"They also reported routine matters to the Admiral. Between midnight and six o'clock in the morning we frequently transmitted as many as two hundred messages. Except for these reports, the Admiral had no definite idea where his scouts were, nor would the scouts have had of the fleet. The distance between the two, of course, varied; but the system worked well whether it was short or long. From the scout not a trace of the smoke from the funnels of the thirty war ships of the fleet could be seen; yet the instrument down in the stateroom was clicking out orders from the Admiral every few minutes.

"Finally the Juno sighted the vessels she was looking for and the message containing this information was sent by the operator on board. Eighty miles distant Sir Compton Domville, in the Alexandra, received the news which enabled him to outmanœuvre the enemy's fleet, bring the convoy in safely and win the mimic naval contest.

Mode of Telegraphing.

"You see, the same condition which obtained in these tests will prevail during the yacht races, with a decrease in the distance to be covered. We can follow the races at full speed and the messages sent out from the tall pole will find their way as swiftly as a flash of lightning to the pole at the receiving station. On the sending ship, after a message has been despatched, we would receive a code word and know that it was received properly and that it was accurate. Then we would be ready to send another message. Should the message be unintelligible to the operator at the receiving instrument, or should the Morse characters be confused, instead of receiving the code word to go ahead on the sending ship we would get a query on the previous message, which would be repeated in whole, or in part, as the case might be.

"Another thing we have found out is that mountains, high buildings, steel masts, etc., do not stop communication. We were able while in Bantry Bay to talk with a ship

lying many miles from us and separated by a chain of hills hundreds of feet high. The message radiated in all directions, and was caught by the pole on the other ship. Again, a very valuable point is that fog does not interfere with a wireless telegraphic message at all. In fact, at times the instruments have appeared to work better in thick weather. The curvature of the earth has also been discounted. With a pole sufficiently high, a message can practically be sent any distance. There was some talk of my attempting to communicate between New York and Chicago, but I do not think I shall make that experiment. I may, however, try it."

It is interesting to note that Marconi did not begin his experiments until 1895, when he began to erect poles and endeavor to establish communication between various parts of his father's estate, near Bologna, in Italy. In 1896 he arrived in England, and after working in conjunction with Mr. W. H. Preece, then chief electrician of the British post office, he gave a demonstration of the capabilities of the system during the volunteer evolutions on Salisbury Plain, and also in the British Channel. More ambitious experiments followed, and wireless telegraphy became a fact and not a theory only.

Marconi's System a Success.

A New York journal, which was interested in the experiments of Marconi and his reports of the yacht race, demonstrated practically for the first time in this country the marvelous triumphs of the new system by which messages are instantly sent over long distances without wires. The journal thus comments: "The practicability and success of the Marconi system have now been fully established. It will be possible to transmit the news almost as quickly and as accurately as it could be done by telephone. During the recent British naval manœuvres the inventor, stationed on the flagship Alexandra, was able to receive two hundred messages in six hours from the scouting cruiser Juno, while the two moving ships were many miles distant from each other, and finally to obtain very important news from the scout when eighty miles distant from the flagship. This was a much more severe test of the new telegraphic system than it will be required to stand in reporting the yacht races. But from a scientific standpoint it is clear that wireless telegraphy will overcome enormous distances.

Principle of Telegraphy.

"The physical principle upon which Marconi's wireless telegraphy is based is as simple as that unconsciously employed in all human speech. In the latter the speaker excites and transmits certain waves of sound of different lengths in the atmosphere, each of which corresponds to a conventional signal or word, and every such sound wave or series of sound waves on entering the ear of the hearer conveys a definite message. The waves excited and transmitted by the Marconi transmitter, however, are excited not in the air but in the ether medium, which certainly pervades all of space through which our planet passes, and probably all interstellar space.

"They are the famous Hertzian waves, discovered and defined by the German physicist Hertz, propagated in the ether—the subtle medium of light and electricity, which is so attenuated that, though it is surely, as Clerk-Maxwell said, 'material and has mass,' it does not appear to be a gravitating substance. It was shown by the laboratory

experiments of Zehnder in 1895 that waves of the luminiferous ether pass freely through solid bodies, just as light passes freely through a pane of glass or through the thick, solid lens of a giant telescope.

"The experiments with the Marconi instruments in England demonstrated that electric vibrations in the ether excited from his transmitter were not arrested by lofty topographical obstacles.

"The signals were transmitted with complete success from the town hall at Dover to the South Foreland Lighthouse and the East Goodwin Lightship through or over cliffs from three hundred to four hundred feet above sea level. A similar transmission of signals through or over Bere Island, rising nearly nine hundred feet above the sea, was recorded during the naval manœuvres.

Not Affected by Weather.

"Marconi's experiments apparently show that the accurate and rapid transmission of messages over long distances from his transmitter to his receiver is entirely independent of ordinary weather variations. The other waves, which are found to penetrate and pass through solid bodies unimpeded, are not stopped or diverted by rain or gale. Every one knows that telegraphy by wires is at times greatly disturbed and even wholly interrupted by storms. But there is not, so far as the experiments have shown, any conclusive reason for supposing that wireless telegraphy will be equally affected. It still appears undetermined whether the Marconi signals will be undisturbed by magnetic storms and earth currents during the occurrence of auroras."

Marconi's greatest success was the transmission of signals from the British coast to St. Johns, Newfoundland, a distance of 1800 miles, on December 11, 1901, and again on the following day. From this it would seem that distance is not a barrier to the success of wireless telegraphy, and the time will come when an instantaneous thought can be made to girdle the globe on wireless wings.

First Suggestion.

Marconi is a product of both Latin and Anglo-Saxon stock, his father being an Italian and his mother English. He was born at Griffone, near Bologna, Italy, on April 25th, 1875. He had excellent educational advantages, having studied under Professor Rosa at Leghorn and Professor Righi at Bologna. He had a liking for chemistry and was in his element when he could carry on investigations and conduct experiments in the chemical laboratory.

In a conversation one day he heard the suggestion made that there might be such a thing as wireless telegraphy. He was struck with the suggestion, and at once set to work to learn if such a thing were possible. He was in a new realm; he saw the footsteps of no discoverers; he had little or nothing to guide him in his investigations; his originality and genius are therefore the more apparent. In 1896 he had advanced so far as to predict success, and went to England to continue his experiments.

His first message transmitted to any great distance was sent across the English channel from South Foreland to Bologna, thirty-two miles. While returning from this country to England in November, 1901, he communicated with the English coast at a distance of sixty-six miles. Granting, as scientific men claim, that wireless telegraphy is yet in its infancy, who can imagine its amazing possibilities or what miracles of achievement will attend its future development.

On July 12, 1901, Santos-Dumont accomplished the marvelous feat of sailing his airship around the Eiffel Tower in Paris. Few persons believed he would succeed in the attempt to solve the problem of aerial navigation, and the announcement of his wonderful achievement created the greatest interest in both Europe and America.

The feature of Santos-Dumont's flight around the Eiffel Tower, upon which experts base their opinion that a great stride has been made toward solving the problem of aerial navigation, is the fact that the daring aeronaut was able to propel his craft against the stiff wind and to control its direction at will.

Sailing in the Air.

The trial lasted forty-one minutes, the distance covered being about nine miles. In that time Santos-Dumont mounted, alighted and reascended without any assistance. He flew straight, in curves, high or low, exactly as he willed, and but for an insufficient supply of petroleum would have crowned with complete triumph a test which, even though a partial failure, stands entirely without parallel.

The trip was made in an effort to win the $20,000 prize offered by M. Henry Deutsch to the first member of the Aero Club who should sail an airship from the club grounds, circle the Eiffel Tower and return to the starting point within thirty minutes.

Animated by the fear that some other inventor might forestall him, Santos-Dumont worked with the greatest haste to finish his balloon, and undoubtedly made the trial before his arrangements were complete. Otherwise the accident which marred the return journey might have been avoided.

The start was made at 6.41. When the word to go was given the balloon shot straight upward, maintaining its horizontal position and perfect equilibrium until a height of sixty feet was reached. Then the head of the balloon was pointed toward the Eiffel Tower, and in graceful spirals it ascended rapidly in the desired direction.

Cheers for the Balloon.

The distance to the tower was covered in thirteen minutes, and at 6.56 spectators assembled on the third platform cheered the balloon as it swept gracefully around the imposing structure and started on the return trip.

This was the remarkable part of the trial. A stiff westerly wind had sprung up, and Dumont had to go dead against it to return to his starting place. Without serious difficulty this was accomplished, and at 7.20 the balloon was hovering over the Aero grounds, the distance of nine miles having been traversed in forty-one minutes. Eleven minutes beyond the limit prescribed in the prize regulations.

The inventor had failed to win the $20,000, but he had demonstrated the practicability of his airship, and proved that it could be controlled either with or against the wind.

An imperfectly regulated motor and the lack of sufficient petroleum almost caused a catastrophe when the descent was made. As the navigator was trying to enter the park the supply of petroleum gave out and, deprived of motor power, the airship buffeted helplessly about at the mercy of the wind.

Fearing that the balloon might be carried into Paris or into the Seine, Santos-Dumont pulled the safety valve, tore a great rent in the silk and allowed the gas to escape. The drag line caught in a tree and the aeronaut

came down in a garden belonging to Baron Edmund de Rothschild, half a mile from the grounds of the Aero Club.

Neither the aeronaut nor his craft was much the worse for the abrupt descent Santos-Dumont had a slight scratch on the hand and the driving shaft of the balloon motor was slighty bent.

Countess d'Eu, daughter of Dom Pedro of Brazil, occupies the estate adjoining the Rothschild grounds and was a witness of the fall of the balloon. After ascertaining that Dumont was safe she sent him champagne and refreshments, to which the inventor did grateful justice.

Sketch of the Inventor.

But for the turn of destiny which deposed Dom Pedro, Santos-Dumont would have been a subject of the titled lady whose hospitality he so unexpectedly received for he is a Brazilian by birth.

He was born in 1873, and weighs but 109 pounds. He made his first balloon ascension in 1897, and was one of the first experts to abandon spherical for cylindrical balloons. Before perfecting his present airship he built no less than four others; in one of his experiments a balloon collapsed and he sustained a fall of many feet, narrowly escaping with his life.

The airship, "Santos-Dumont, No. 5" is shaped like a cigar, with both ends pointed. It is about 100 feet long and 18 high.

Beneath the balloon, suspended by thin steel wires, is a cradle fifty feet in length, composed of three bent pine poles, bound together with aluminum.

The motor is placed twenty-one feet from the front end. It has a capacity of sixteen horse power and is a marvel of lightness and strength.

The motor operates a four flanged screw which revolves at the rate of 200 turns a minute. The operator's basket is so situated that he can control by means of lines the rudder and valves of the motor and by means of a long guide rope trailing from the cradle he is able to alter the balloon's displacement and control its direction as desired.

Over the Mediterranean.

Santos-Dumont, with his dirigible balloon, as it is called, that is, a balloon that can be steered, made two excursions over the Mediterranean on January 28th, 1902, at ten o'clock and at two, amid the applause of many spectators who had come from all points on the littoral, among whom were the Duke de Dino, the Principa and Principesa Russpoli, M. Olivier Ritt, Governor General of Monaco, and M. and Mme. Camille Blanc.

The aeronaut did not, however, give his airship all the speed of which it is capable. He was accompanied in the morning by the sloop Monte Carlo, having on board its owner, M. Cabireau, and in the afternoon by a steam sloop of forty horse power from the American yacht Varuna, having on board its owner, Mr. Higgins, and a number of passengers.

In the morning Santos-Dumont made the circuit of the bay several times and in the afternoon he executed a number of evolutions and returned to the starting point.

The trials in the afternoon were most important, and the success of the aeronaut surpassed even the success he achieved in Paris last year. After having moved about in all directions, without any pitching movement, at a height varying between two hundred and three hundred feet above the waves, he went so far out over the open sea that it was

thought for a moment that he had started for Corsica.

But this voyage did not enter into the intentions of the aeronaut, because his airship was not fitted for long voyages. At the end of half an hour Santos-Dumont was seen to turn. Describing a curve, he returned in the direction of the Port d'Hercule, passing alongside the terrace of the Casino and the Tir aux Pigeons, where he was loudly applauded.

In a few moments he succeeded, as he had done in the morning, in the diffiult operation of making a landing on the narrow space between the aerodrome and the bay. He was congratulated for his skill and delicate manœuvre, but the aeronaut, modestly declining all praise, attributed as heretofore the successful result of his trials to the protection afforded by the medal given him by the Princess Isabel.

In order to facilitate his future landings the principality constructed in the bay a wooden jetty, where the floating guide rope can be grasped at the moment of the return of the airship. In the general enthusiasm members of the English and American colonies entered into good natured disputes as to which city, London or New York, would be favord next by sensational trials of the aeronaut.

A Landing Constructed.

As soon as Santos-Dumont returned to the aerodrome he sent to the President of the Republic of Brazil the following despatch :—"Went out on the open sea with great success. My experiments will continue every day when the weather is fine."

Many years ago John P. Holland became fascinated with the idea of constructing a boat that would navigate the sea far below the surface. Such navigation at that time was unknown, and Mr. Holland had nothing by which to be guided. He clung to the bold conception of building a boat that would dive and swim, stay under water as long as he wished, and then come to the surface, ready for another plunge. He had great difficulties to contend with, chief of which was the fact that no one else believed such an achievement possible. But the word "impossible" never halts men of Mr. Holland's calibre.

A Practial Invention.

The idea of such a boat came to Mr. Holland in the school-house in Cork, Ireland, where in spare hours he devoted himself to the study of navigation, always believing he would some day plan vessels that would revolutionize naval warfare. He wanted to build a boat that would plunge under water and destroy battleships and the large naval craft. The idea of a sub-marine boat was suggested to Mr. Holland by an account of experiments made by Fulton and Bushnell, and he actually made a diagram of a sub-marine boat as far back as 1862, soon after the famous battle between the Merrimac and the Monitor in Hampton Roads.

Suffice it to say that Mr. Holland has proved by several boats he has built that sub-marine navigation is a practical thing. He has demonstrated this to the United States Government, and has received an order for eight sub-marine boats to be used in naval service. But even here in our wide-awake country Mr. Holland has found naval officers and others very slow to believe that he had an invention that could be turned to practical account. A man of less determination and push would have given up long ago and retired from the field.

For six years after his arrival in this country Mr. Holland taught school at Paterson, N. J., and during this time was seeking moral and financial aid to carry out his favorite project. In 1875 he submitted a plan to our government for a sub-marine boat 15 feet long, shaped like a cigar, to accommodate one man sitting upright and operating the propeller by means of a treadle. One naval officer condemned this design in very sarcastic terms, but eventually a boat of this kind was constructed at the expense of Mr. J. Breslin, of Paterson, and was successfully tried in the Passaic river.

This was a distinct triumph for the inventor, and he at once abandoned school-teaching to superintend the construction of his new craft. In 1881 it was launched. Mr. Breslin became a powerful supporter of the inventor, and has aided him in fully realizing what was once thought to be only a visionary scheme. The boat called the "Holland" has been built since 1895, and on many occasions has demonstrated its ability to sub-navigate the sea. Mr. Holland's invention will be of service to the United States Navy; the contract price for the boats ordered is $175,000 each.

Experts in naval warfare claim that this invention will do much to revolutionize naval warfare. A boat that can go under water, turn this way and that, back or go forward, and approach the submerged hull of a battle-ship with weapons of destruction, has a mission in forthcoming naval warfare

IMMENSE QUANTITY OF DYNAMITE

USED DAILY IN NEW YORK CITY FOR CONSTRUCTING GREAT BUILDINGS, TUNNELS, SUBWAY, ETC.

NEW YORK'S daily ration of dynamite exceeds seven thousand pounds. During the last few years the demand for the explosive has increased beyond all precedent. The city's great buildings, reared upon ever deeper foundations; the subway construction and various tunnelling enterprises have rendered this very deadly agent almost as common, commercially, as cheese or tallow. Nevertheless, dynamite is as blindly and ignorantly feared to-day as when it first appeared.

No commodity in general commercial use is probably so little understood as dynamite. The public is all wrong, or nearly so, in its ideas of its character. It is regarded by the great majority of people with abject, almost hysterical, fear. Any one accustomed to handling dynamite will tell you that the actual danger is very slight. The death rate among dynamite workers is very low.

Dynamite is packed without special precautions, like so much soap. It is shipped, in car lots of 25,000 pounds at a time, to all

parts of the country, and usually survives even railroad collisions without mishap. It may be cut up or broken, frozen and thawed out, and even burnt almost with impunity.

It is not difficult to find men to work in dynamite factories. The employment is said to be attractive. The number of deaths in such factories is not startling, compared with the number maimed or killed on railroads or in great manufacturing plants. The very violence of the catastrophes, when at long intervals they come, exerts a curious fascination upon many.

The composition of dynamite and the general methods of its manufacture are, of course, more or less familiar. The dynamite commonly used in New York is formed of about forty per cent. of nitroglycerine, mixed with some solid absorbent, inert substance, usually some kind of earth, and with about five per cent. of camphor.

Dynamite Factories.

The greatest danger in these dynamite factories is from the workmen becoming careless from long acquaintance with danger. It is a common practice in these establishments to lay off workmen, sometimes for a year at a time, until they came back to a proper sense of the danger of their position. The work itself is not unwholesome. Dynamite factories are rarely bothered with sightseers, though the process is extremely interesting. The men, as a rule, wear rubber gowns and gloves, with odd looking aluminum helmets to protect them from the splashes of acids.

It is very unusual to lose dynamite during transportation. Contrary to the general idea no precautions are taken in packing or storing it, even in very large quantities. The cartridges, as a rule, measure an inch and a half in diameter, and from six to eight inches in length. These are nailed up in ordinary soap boxes and are literally thrown about by baggage smashers with impunity.

The ordinary freight car is used for carrying dynamite, and a carload frequently exceeds 25,000 pounds of the explosive. The cars are marked "Explosive, with care," and are attached to ordinary freight trains. They are supposed to be placed in the middle of the trains, but the rule is often ignored.

Two serious accidents to dynamite cars while in transit show that workmen often become careless. In both cases these were due to carelessness, and illustrate the contempt which long familiarity has bred for dynamite with the railroad man.

In one instance a car carrying some fifteen tons of dynamite was attached to the very end of a long freight train, against all rules. All would probably have gone well, however, had the train not suffered a rear end collision. A locomotive crashed into the dynamite car and buried itself half way in dynamite and set it on fire. This was more than dynamite could stand. Incidentally the explosion cleared the track of all wreckage for a considerable distance.

In the other case the dynamite car caught fire from a burning hot box, and the train men, noticing it, scorned to put out the fire, but retreated to a hill near by. The explosion threw a nearby turntable about a quarter of a mile and completely demolished a large engine house.

New York receives its daily ration of dynamite regularly once a day. It comes in car lots, and is unloaded usually upon some Jersey City dock, to be stored nearby for the daily distribution. The boats and wagons which carry the dynamite do not, as a

rule, bear any distinctive mark, but accidents are practically unknown. Large quantities of the explosive are stored in houses near the Palisades, above Fort Lee, on the Jersey shore, or upon boats back of City Island, outside of the regular channel.

From these magazines it is brought to the city regularly every morning for distribution. There are two hundred licensed magazines, at each of which a maximum quantity of sixty-two pounds of dynamite may legally be stored.

The exact properties of dynamite are still more or less of a mystery, even to those most familiar with it. Many rules have been laid down for dynamite, which hold good in every case except one in a thousand, but there is the possibility of this thousandth chance upsetting all calculations.

Men who have spent their lives about dynamite have been killed by its apparently inexplicable action. It has been found by experiment that dynamite freezes at forty-five degrees and explodes at 360 degrees Fahrenheit. It is supposed to be absolutely harmless when frozen. But these rules have some notable exceptions. Dynamite has been known to explode when apparently frozen, and with terrible results. It can only be supposed that some part of it was not frozen or that frozen dynamite has some mysterious properties not yet understood.

Under ordinary conditions dynamite will burn as readily as sugar. It gives off a reddish flame when ignited, though most observers have not waited to watch the results very closely. At other times a flame will explode it; no one understands exactly why. The same mystery surrounds the use of concussion for setting it off. Even a violent jarring will not explode dynamite once in a hundred times. Tons of it have gone through railroad collisions without exploding, when the car carrying it has been completely demolished.

Cartridges have been dropped from the roofs of ten story buildings or have been hammered like putty without result. Then again, a slight shock has set off cartridges which had been packed with the greatest precaution.

Testing the Strength.

A number of machines have been devised for testing the exact strength of dynamite, but none has been found which will stand the strain. There are at present three regular standard ways of measuring the strength of dynamite. One plan is to place a fixed quantity of dynamite in the inside of a strong iron nut, placing it on top of a lead cylinder of given dimensions. The charge, when ignited, compresses the cylinder to a thin disk. By using cylinders of the same size a fairly exact measure of the force may be obtained.

A charge of five grains of dynamite placed over a cylinder one inch high and one inch in diameter will usually serve to compress it to a disk eleven thirty-seconds of an inch thick.

Another method of measuring its force is to fire a very heavy ball from a large mortar with a small charge of dynamite. The distance the ball is thrown is taken as a measure of the force of the explosive. By using the same ball and mortar in all experiments fairly accurate comparative tables have been obtained.

In the trade dynamite is rated by the percentage of nitroglycerine it contains. The common commercial dynamite used in New York is known as "forty-five per cent." The most powerful dynamite contains nearly eighty per cent. nitroglycerine.

CIVIL SERVICE.

Aim of Civil Service—Examinations, How Conducted—The Causes for Removals —Grading Applicants—Method of Promotion.

BESIDES the hundreds of elective offices there are thousands of positions under the general, state, city and county governments that need efficient men and women for the performance of duties to carry on the government. There are thousands of postmasters, letter-carriers, diplomatic agents, clerks in the various departments at Washington and custom-house officials; similar offices under the state government, in state institutions; in the counties, road builders, poorhouse attendants, etc., and in the cities and towns, the clerks, police, inspectors and others necessary to see that the business of the people is properly done. Employés of the government aside from elective offices are called the civil service.

Time was when all these offices in the different countries were filled with appointments by certain influential heads of government. No sooner was one party out of power than all the adherents to that faction were thrown from office and new hirelings brought up to fill their places. Oftener than otherwise the new appointees had to pay their superiors large premiums to secure the places, and when in turn these superiors fell by the disapproval of the king or people the civil service employés were once more replaced by others.

In the United States there was little abuse of this kind until the administration of President Andrew Jackson, and to him was left the questionable glory of framing the phrase, "To the victor belongs the spoils," which meant that he, at least, intended to remove every one not in accord with his politics and appoint men who would support him at the next election. Since that time and until recently there has been a shameless use of this influence and patronage, and with it a proportionate waste of public funds resultant upon the disregard with which efficient and thorough employés were replaced by ignorant office-hunters. At times but few of the many clerks employed by the federal government were left in office after a presidential election, and many times the post-office department was sorely crippled by the dismissing of thousands of capable men who had learned their work thoroughly, simply to fill the positions with political supporters who in turn would be expelled after the next election.

Public Aroused to Danger.

This abuse reached such a degree that the public realized a great deal of its hard-earned money was going into sink-holes and never coming to light again. In 1883 laws were framed and passed by Congress limiting the power of officials in removing certain officers. Rules were

adopted which called for examinations of merit of the different applicants for office. Three commissioners were stipulated by this law to see that its proper regulations were carried out. Application shall be regarded upon merit alone and without regard to political preferences. No person habitually addicted to the use of intoxicants may be appointed to any position, nor may any one receive such appointment unless he or she may have received a standing of 65 per cent in the first three branches examined. The examinations, which are competitive, are generally on the following subjects: (1) Orthography, penmanship and copying; (2) arithmetic —fundamental rules, fractions and per centage; (3) interest, discount and the elements of bookkeeping; (4) elements of the English language, letter-writing and the proper construction of sentences; (5) elements of geography, history and the government of the United States.



SMITHSONIAN INSTITUTE (COLLEGE OF SCIENCES), WASHINGTON, D. C.
Founded 1846 by James Smithson "for the increase and diffusion of knowledge among men." Here are kept all important government documents and relics.

No applicant will be received unless he can furnish proof of his good moral character and is in good health, but any recommendation of any senator or congressman or other official further than as

to character will not work to the advancement of the applicant. Women receive as much pay as men in the appointments, and while no one may be appointed without a merit examination, no one may be removed without cause.

This civil service law covers a great many offices, but even to-day there are thousands of positions that should be placed under its protection. In the different states many laws similar in character have been adopted for use in the filling of county, city and state positions. While these laws are abused to a great extent, and elected officials in power evade them grossly, yet they are a step in the right direction toward upbuilding the efficiency of the working government of the whole people and the reduction of expenses.

Qualifications for Examination.

To fully illustrate the workings of the civil service law and what applicants for positions must go through, the following extracts from the civil service law of Illinois practiced in the city of Chicago are given. Under this law more than 11,000 people obtain official positions in the city of Chicago. The law in itself, while not always rightly administered, is pronounced to be one of the best in existence in this country, and corresponds practically with the national law.

"*Citizenship and Residence.*—No person shall be admitted to examination for any position in the Official Service who is not a citizen of the United States, and who has not been an actual resident of the city of Chicago for at least one year next preceding the date of examination.

'*Age.*—Unless otherwise provided in these rules, no person shall be admitted to examination for a position in the Official Service who is less than twenty years of age at the date of examination, except that applicants for positions of pages and messengers must not be less than seventeen years of age at the date of examination.

"*Waiver of Local Residence in Special Examinations.*—In special examinations for any place requiring technical, professional, or scientific knowledge, or manual skill of a high order, the Commission may waive the requirement of residence in the city of Chicago, fixed in Section 1 of this rule.

"*Application, How Made.*—Application for admission to examination shall be made on blanks in such form and manner and supported by such certificates of persons acquainted with the applicant as the Commission may prescribe. These blanks will be furnished directly to applicants for examination.

No Religious Prejudice.

"*Political or Religious Opinion Not to Influence Appointments.*—No question in any examination shall relate to political or religious opinions of affiliations, and no appointment or selection to an office, or for employment within the scope of these rules, shall be in any manner affected or influenced by such opinions or affiliations.

"*Place, Time and Notice of Examinations.*—Examinations shall be held at such times and places as the Commission may designate, and two weeks' notice thereof shall be given, as provided by law.

"*Subjects of Examination.*—The subjects of examination shall be designated from time to time by the Commission, and shall be such as the needs of the service require and such as tend to prove the qualifications of the applicant for the office sought, and may include special tests of fitness for any particular place requiring

technical, professional or scientific knowledge, or manual skill.

"*How Graded.*—Proficiency in any subject shall be credited in grading the standing of the person examined, in proportion to a value of a knowledge of such a subject in the branch or part of the service which the applicant seeks to enter, and of physical qualifications and health. The relative weight of each subject shall be fixed by the Commission for every examination.

"*Must Obtain Seventy Per Cent.*—The name of no person shall be entered on a register of eligibles whose standing, upon a just grading in the examination, shall average less than 70 per centum of complete proficiency in the subjects of the examination, taken as a whole, and of such minimum mark as may be fixed by the Commission for any part thereof.

"*Method of Examination and Marking.*—All questions used in any examination shall be first approved by the Commission. All examinations shall be conducted under the supervision of, and examination papers shall be marked under the regulation of, the Commission. The same series of examination papers shall not be used a second time. No examina-



THE GOVERNMENT BACTERIOLOGICAL BUREAU.

On Halsted Street near the stockyards, Chicago, where several hundred young women make microscopical examinations of the slaughtered cattle.

tion papers and no examinations shall be subject to review by the Civil Service Commission or any of its members after posting of the eligible lists.

How Enrolled.

"*Method of Enrollment.* — All competitors who attain a general average of 70 per centum or over (and of such minimum mark as may be fixed by the Commission for any part thereof) shall be eligible for appointment to the place for which they were examined, and their names shall be enrolled in the order of general average upon the proper registers, which shall be in such form as the Commission shall prescribe, and shall be called 'Registers of Eligibles.'

"*Time of Remaining on Registers of Eligibles.*—Names shall remain upon the registers of eligibles for two years from the date of their enrollment, unless sooner removed under authority contained in these rules or by appointment. At the expiration of one year the eligible shall, upon a form prescribed by the Commission, furnish new certificates of character.

"*Method of Promotion.*—All promotion in the classified service, unless herein otherwise provided, shall be from grade to grade, and shall be made upon voluntary, open, competitive examination. Competition in such examinations shall be limited to the employés in the next lower grade of the same division serving in the department in which the position exists, unless the Commission shall deem it for the interest of the service to admit competitive employés in other grades or other divisions serving in that or other departments.

"*Cause for Removal; Charges, How Made.*—Section 12 of said act provides that no officer or employé in the classified service who shall have been appointed under these rules and after examination shall be removed or discharged except for cause, upon written charges, and after an opportunity to be heard in his own defense. When a removal is deemed necessary, the appointing officer shall immediately notify the Commission in writing of the grounds therefor. Such grounds shall be investigated by the Commission, and the accused person shall be given an opportunity to be heard in his own defense, provided, however, that such officer or employé file a written statement requesting an investigation within three (3) days after the date of his separation. The finding and decision of the Commission shall be certified to the appointing officer, and shall be forthwith enforced by said officer. Pending such investigation, the appointing officer may suspend the accused for a reasonable period, not exceeding thirty days. Nothing in this section shall be construed to require such charges or investigation in cases of laborers or persons who have the custody of public money, for the safekeeping of which another person has given bonds."

The previous pages give a general idea of the Civil Service Laws, their application and benefits. The following pages give in detail information for the benefit of the Civil Service applicants in all branches of the Service.

THE CIVIL SERVICE

ITS OPPORTUNITIES AND REQUIREMENTS.

APPLICATIONS AND EXAMINATIONS.

POSITIONS AND HOW TO OBTAIN THEM.

A SPLENDID FIELD FOR THE AMBITIONS OF MEN AND WOMEN.

EXTENT OF THE CLASSIFIED CIVIL SERVICE.

All that part of the executive civil service of the United States which has been or may hereafter be classified under the civil-service act shall be arranged in branches as follows: The Departmental Branch, the Custom-House Branch, the Post-Office Branch, the Government Printing Branch, and the Internal-Revenue Branch.

The Departmental Branch shall include officers and employees as follows, except those in the service of the Government Printing Office and in the service of the several custom-houses, post-offices, and internal-revenue districts:

(*a*) All officers and employees of whatever designation, except persons merely employed as laborers or workmen and persons whose appointments are subject to confirmation by the Senate, however or for whatever purpose employed, whether compensated by a fixed salary or otherwise, who are serving in, or on detail from—

The several Executive Departments, the commissions, and offices in the District of Columbia.
The Railway Mail Service.
The Indian Service.
The several pension agencies.
The Steamboat-Inspection Service.
The Marine-Hospital Service.
The Light-House Service.
The Life-Saving Service.
The several mints and assay offices.
The Revenue-Cutter Service.
The force employed under custodians of public buildings.
The several subtreasuries.
The Engineer Department at large.
The Ordnance Department at large.

(*b*) All executive officers and employees outside of the District of Columbia not covered in (*a*), of whatever designation, except persons merely employed as laborers or workmen and persons whose appointments are subject to confirmation by the Senate, whether compensated by a fixed salary or otherwise—

Who are serving in a clerical capacity, or whose duties are in whole or in part of a clerical nature.

Who are serving in the capacity of watchman or messenger.

Who are serving in the capacity of physician, hospital steward, nurse, or whose duties are of a medical nature.

Who are serving in the capacity of draftsman, civil engineer, steam engineer, electrical engineer, computor, or fireman.

Who are in the service of the Supervising Architect's Office in the capacity of superintendent of construction, superintendent of repair, or foreman.

Who are in the service of the Treasury Department in any capacity.

Who are employed in the Department of Justice under the annual appropriation for the investigation of official acts, records, and accounts of officers of the courts, and all officers and employees in the penitentiary service who are by law subject to classification.

The Custom-House Branch includes all officers and employees who have been, or may hereafter be, classified, who are serving in any customs district.

The Post-Office Branch includes all officers and employees who have been, or may hereafter be, classified, who are serving in any free-delivery post-office.

The Government Printing Branch includes all positions in the Government Printing Office except those of Public Printer and *unskilled* laborers or workmen.

The Internal-Revenue Branch includes all officers and employees in any internal-revenue district who have been, or may hereafter be, classified under the civil-service act.

SALARIES.

Of the hundred thousand positions in the government service, with the number increasing every year, the salaries range from six hundred dollars to five thousand. To know the salary attached to each particular branch of the service, it will be necessary for the applicant to apply to the given department for the manual of the classification service.

APPLICATION BLANKS REQUIRED.

Below will be found an alphabetical list of the schedule examinations, showing the form numbers of the application blanks which must be executed for the different examinations. The form numbers of the required blanks are in parentheses following the names of the examinations. The general application blank, Form 304, must be executed and filed for nearly all examinations, while supplementary statements on additional forms must be filed for technical, trades, and certain other positions. Each ap-

plicant should be careful to see that the proper blank or blanks have been sent for the examination desired; otherwise he should immediately request the Commission to forward the proper blank as shown by the list, stating the examination desired and the number of the blank wanted. Whenever more than one form of application blank is used, both forms should be forwarded to the Commission in the same envelope. However, in case the applicant first receives only Form 304, that form should be immediately exe-



The Capitol at Washington. One of the finest marble structures in the world. First built in 1800, destroyed by the British in 1812, and rebuilt 1816.

cuted and forwarded, and the supplementary statements, if required, should be forwarded as soon as possible thereafter.

TITLE OF EXAMINATIONS AND FORM NUMBERS OF APPLICATION BLANKS REQUIRED.

Aid, Coast and Geodetic Survey (304 and 375).
Assistant topographer (304 and 375).
Book typewriter (304).
Clerk, promotion, departmental service (372, or 304 and 372).
Clerk, qualified as stenographer and typewriter, Land Office service, (304).
Copyist, topographic draftsman (304 and 375).
Elevator conductor (304 and 394 or 1093).
Hospital steward, Marine Hospital Service (304 and 375).
Meat inspector (304 and 375).
Press feeder (304 and 1145).
Railway mail clerk (304).
Register and receiver's clerk (304).
Skilled laborer, Government Printing Office (304).
Stenographer (304).
Stenographer and typewriter (304).
Surveyor-general's clerk (304).
Typewriter (304).
Topographic draftsman, General Land Office and departmental service (304 and 375).
Translator (304).

Note.—*For all special information desired,* ADDRESS, U. S. CIVIL SERVICE COMMISSION, WASHINGTON, D. C.

State plainly in fewest words what is wanted.

THE QUESTION OF HELP IN SECURING POSITIONS.

In order to protect aspiring persons seeking information, the Commission has issued the following statement:—

"The Commission frequently receives letters from different parts of the country inclosing advertisements of individuals and bureaus claiming to have special information of value to applicants and special facilities in preparing them for civil-service examinations. The writers of these letters inquire whether, in the opinion of the Commission, the claims of these individuals and

bureaus are genuine or not. Attention is called to the fact that the Manual of instructions and the schedule of examinations, which are furnished to every applicant upon request, contain all the information about the times and places of examinations, the method of marking papers, certifying eligibles, and the prospect of securing appointments, and they also contain specimen questions and examinations. No person has any information of importance to applicants concerning examinations which can not be obtained without cost from this Manual or by request to the Commission. All claims to the contrary are therefore misrepresentations.

"This Manual is intended to furnish all the information which applicants will need concerning the classified civil service. These instructions should be carefully read, as they answer most of the questions which applicants ask in their letters of inquiry, and if carefully studied will save much needless correspondence. Letters in regard to examinations and other business of this Commission should not be addressed to members of Congress or other persons not connected with the commission, as this only causes delay and does not in any way assist the applicant. Such communications should be addressed directly to the United States Civil Service Commission, Washington, D. C."

PERSONS WHO SHALL NOT BE EXAMINED.

No person is eligible to an examination—

(*a*) Who is not a citizen of the United States (see sec. 29, Regulation V);

(*b*) Who is not within the age limitations prescribed for the examination for which he applies (see sec. 14);

(*c*) Who is physically disqualified for the service which he seeks;

(*d*) Who is addicted to the habitual use of intoxicating beverages to excess;

(*e*) Who is barred by Application Regulations IX and X (see sec. 29);

(*f*) Who is enlisted in the United States Army or Navy, and has not secured permission for his examination from the Secretary of War or the Secretary of the Navy, respectively.

(*g*) Who has been dismissed from the public service for delinquency or misconduct within one year preceding the date of the examination selected by him;

(*h*) Who has failed after probation to receive absolute appointment to the position for which he again applies within one year from the date of the expiration of his probationary service;

(*i*) Who has made a false statement in his application, or has been guilty of fraud, or deceit in any manner connected with his application or examination, or who has been guilty of crime or infamous or notoriously disgraceful conduct.

Applications will not be received from legal residents of the District of Columbia for the bookkeeper, clerk, compositor, elevator conductor, messenger, and watchman examinations unless such applicants are allowed preference under section 1754, Revised Statutes. This does not apply to the custom-house, internal-revenue, and post-office services.

AGE LIMITS FOR THE CLASSIFIED CIVIL SERVICE.

Section 4 of Civil Service rule V provides as follows: No application for examination shall be accepted unless the applicant is within the age limitations fixed herein for entrance to the position to which he seeks to be appointed: *Provided,* That, subject to the other conditions of these rules, the application of any person whose claim of preference under the provisions of section 1754 of the Revised Statutes has been allowed by the Commission may be accepted without regard to his age. (See sec. 176.) The age limitations for entrance to positions in the different branches of the service shall be as follows:

	Minimum.	Maximum
Departmental Branch:		
Page, messenger boy, apprentice (other than apprentice in mints and assay offices) or student	14	20
Apprentice in mints and assay offices	18	24
Printer's assistant and messenger	18	No limit.
Positions in the Railway Mail Service	18	35
Hospital stewards in the Marine Hospital Service	21	30
Keeper, assistant keeper, and officers of light ships in the Light-House Service	18	50
Cadet in the Revenue-Cutter Service, and aid in the Coast and Geodetic Survey	18	25
Surfman in the Life-Saving Service	18	45
Superintendent, physician, supervisor, day-school inspector, disciplinarian, matron, and assistant matron in the Indian Service; inspector and assistant inspector of hulls, and inspector and assistant inspector of boilers in the Steamboat-Inspection Service	25	55
Observer in the Weather Bureau Service	18	30
All other positions	20	No limit.
(The age limitations shall not apply in the case of the wife of the superintendent of an Indian school who applies for examination for the position of teacher or matron.)		
Custom-House Branch:		
All positions	20	No limit.
Post-Office Branch:		
Letter carrier	21	40
All other positions	18	No limit.
Government Printing Branch:		
All positions (male)	21	No limit.
All positions (female)	18	No limit.
Internal-Revenue Branch:		
All positions (male)	21	No limit.

WHEN EXAMINATIONS ARE HELD.

The regular schedule examinations are held, for the Departmental and Government Printing

Branches, twice a year, unless otherwise specified in the spring and fall. Those of the spring are in March and April, those in the fall in September and October.

When the applicant desires to know the exact time and place, he must write to the U. S. Civil Service Commission, Washington, D. C.

SECURING, EXECUTING, AND FILING APPLICATION BLANKS.

The application blank and Manual for the Departmental, Government Printing, and Internal-Revenue branches of the classified service may be obtained by writing directly to the "United States Civil Service Commission, Washington, D. C." Each applicant must, however, write for his own application blank, as it is contrary to the practice of the Commission to forward blanks to one person for the use of another.

There is no need of seeking the aid of any prominent or presumably influential person to secure an application blank or an examination, and no recommendations other than those provided for by the Commission should be forwarded, as the rules forbid the filing of any such letters with the application.

No person will be admitted to a schedule examination who has not previously filed the proper application for the particular examination which he seeks, on the form which will be furnished by the Commission upon request of the applicant. For some examinations a supplementary blank will be required in addition to the regular application blank, and both blanks must be executed and forwarded to the Commission.

Full instructions for the execution of the application will be found on the blank itself, and applicants are cautioned to answer all questions and conform in all respects to the printed instructions. A failure to do this causes unnecessary delays and great annoyance to the applicant as well as to the Commission. Very many applications have to be returned for correction on account of carelessness in the execution of either the application or vouchers.

An applicant should first decide what kind of examination he desires to take. Applicants should be careful to see that the dates and places selected are those on and at which the kind of examination desired may be taken. Care in this respect will save both the applicant and the Commission much trouble.



A view of the White House grounds from one of the windows of the White House.

Applicants for the Departmental and Government Printing branches of the classified service may be examined at places selected from the schedule outside of their own State if more convenient, provided the date and place selected for examination be indicated in the application; *but applicants for the Custom-House, Internal-Revenue, or Post-Office branches of the classified service must be examined in the custom-house or internal-revenue district or at the post-office in which they desire employment.*

Where an applicant desires to compete in two or more examinations in which the grade subjects are the same, such as clerk, bookkeeper, etc., of the first grade, or watchman, messenger, etc., of the third grade, and examinations for farmer and industrial teacher, matron and seamstress, or clerk, stenography, and typewriting, only one application is necessary, provided each examination desired is specifically mentioned in the application; but separate applications must be filed for the Post-Office, Custom-House, or Internal-Revenue services, and for all examinations wherein the basis subjects differ materially, as in the departmental clerk, railway mail, and tagger examinations.

If the examinations requested in the application require evidence as to experience, a separate form for this experience must be filed for each of the different examinations desired.

An applicant may take only one kind of examination at one time and place, except that he may take tagger and railway-mail clerk and clerk, typewriting and stenography on one schedule date, provided these examinations are given during the series.

APPLICATION REGULATIONS.

APPLICANTS SHOULD READ THE FOLLOWING REGULATIONS GOVERNING THE APPROVAL OF APPLICATIONS, AS THESE REGULATIONS WILL BE STRICTLY OBSERVED.

I. Time limits for filing: Applications for the regular schedule examinations may be filed at any time, but unless received at the Commission at least ten days prior to the date selected for the examination they will not be accepted for that examination. This does not apply to applications filed for examinations which are held on dates other than those mentioned in the schedule. Applications received less than ten days before the date set for an examination may be changed to apply for any other examination to which the applicant may be eligible and which will be held during the current series, provided the request for such change is received at least ten days prior to the date of the examination selected. When an application is approved and the applicant given an opportunity to be examined at one semi-annual series of examinations, for the Departmental and Government Printing services, or for any special examination which may be held, and fails for any reason to appear for examination, that application will not be good for the next examination of the kind held. An application will not be approved which is dated or the vouchers of which are dated more than six months prior to its receipt by the Commission. Applications for examinations to be held only when vacancies occur will not be received until such examinations are announced.

II. Applications not accepted on day of examination: No person shall be admitted to a regular schedule examination whose application has not been previously filed with the Commission and approved in accordance with Regulations I. Examiners are prohibited from accepting applications on the day of examination and from admitting persons who have not complied with the requirements and procured admission cards or other proper authority in advance.

III. Application to be executed in ink: Every question in the application must be fully answered. All writing in the applications, vouchers, and certificates must be in ink, and in the handwriting of the signer. Applicants for certain trades examinations requiring no scholastic tests may sign their applications by mark, if unable to write.

IV. Name to be uniform: In all places in the application, vouchers, and certificates the first name, middle initial, and surname of the applicant must be correctly given and must be uniform or consistent throughout the application. Women must prefix the title Miss or Mrs. The post-office address must be in the handwriting of the applicant, and will be changed only upon the written order of the applicant, which order, when received, will be filed with the application.

V. Citizenship: All applicants must make oath in their applications to their United States citizenship. In the case of foreign-born citizens, proof of citizenship must be furnished. If naturalized, the certificate of naturalization must accompany the application. A foreign-born person who claims that his parents were citizens of the United States at the time of his birth must furnish the sworn statements of at least two disinterested persons to prove that to their knowledge his parents were United States citizens at the time of the applicant's birth, and that they did not previously, then, or at any subsequent time renounce, or legally declare their intention of renouncing, their United States citizenship, and also that the applicant is the reputed child of the person through whom he claims citizenship. A foreign-born citizen who was naturalized by the naturalization of his father or his mother while he was a minor must furnish the parent's certificate of naturalization and the sworn statements of two disinterested persons to prove his identity as the child of the one whose certificate is furnished. A woman who claims naturalization through marriage to a citizen of the United States must furnish evidence of the husband's citizenship (his certificate being required if he is a naturalized citizen) and evidence of her marriage to him.

An application from a foreign-born person claiming citizenship, but failing to furnish the required proof, will be canceled. A declaration of intention to become a citizen will not be accepted in lieu of a certificate of naturalization. When naturalization papers are lost, certificate must be procured from the court that issued the naturalization papers, showing the facts in the case.

VI. Jurat; legal residence: Every applicant

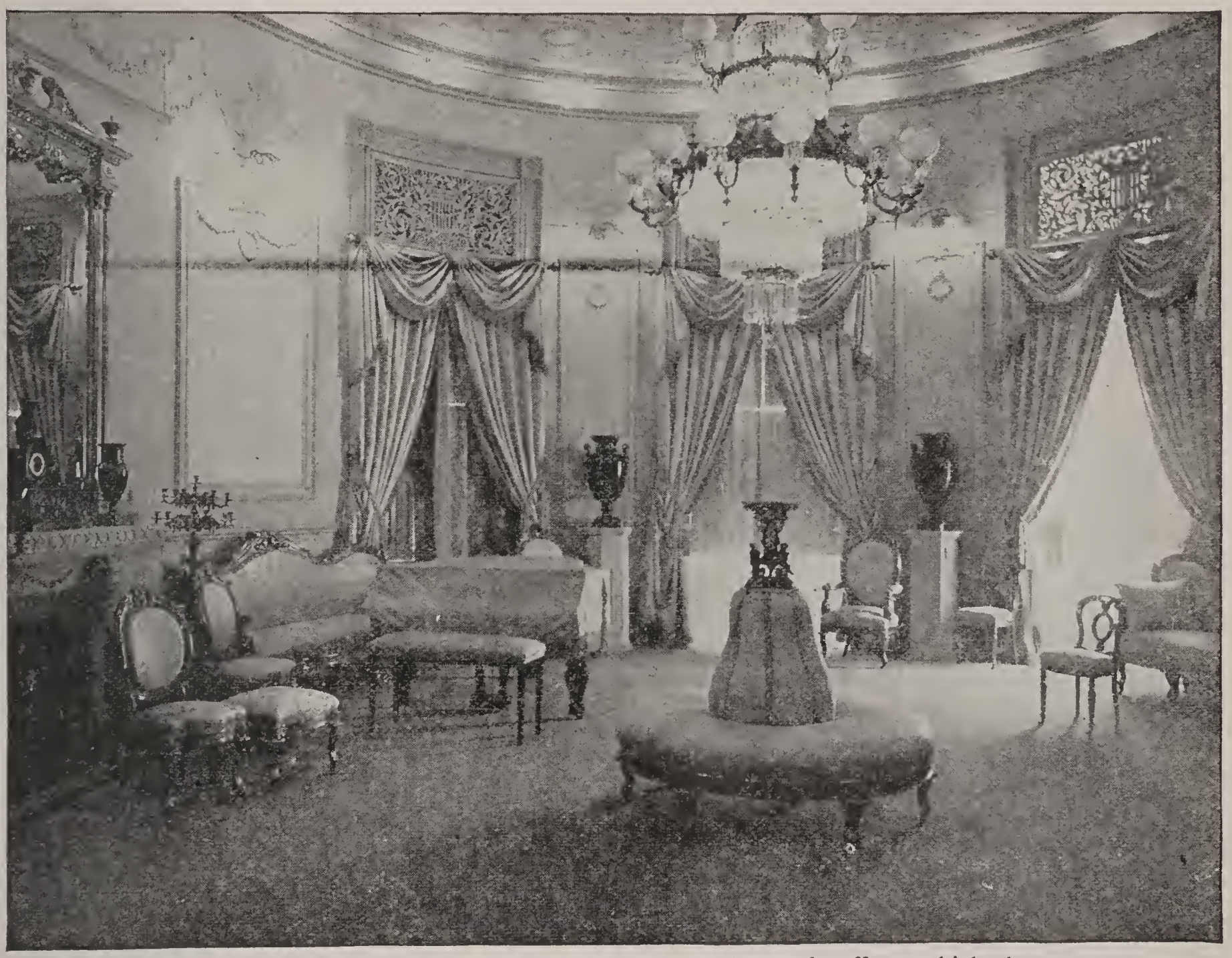
must personally appear and make oath to the statements in his application before an officer who is authorized to administer oaths for general purposes, and the officer's signature must be authenticated by his official impression seal. If the officer has no official seal, he must obtain a certificate of his authority from the proper officer who has the custody of an official seal, which certificate must be attached to the paper.

Every applicant must make oath in his application to the place of his legal residence, which must be shown continuously to the exact date of application, and which must be corroborated by the vouchers required on his application paper. Legal residence does not require continuous bodily presence, but refers to the place at which the applicant, if a voter, is legally entitled to exercise the right of suffrage. Applications for examinations for positions in the departments at Washington, subject to the apportionment law, must show that the applicant has been a legal resident of the county in which he claims legal residence for not less than six months next preceding the date of his application. A married woman living apart or divorced from her husband may for the purpose of filing an application for examination claim legal residence other than that of her husband, but she must furnish a sworn statement of the facts on which her right to a separate legal residence is based. The Commission will decide in each case whether the evidence presented establishes the claim. The legal residence of minors is the same as that of the parents or guardians.

VII. Observance of age limits: No application shall be approved if the applicant is under the minimum age required for the examination which he seeks, or if he is past the maximum age limitation, on the date of the examination.

VIII. Crime, persons indicted for: Persons who have been indicted for, or convicted of, any crime must inclose with their applications a certified copy of the court proceedings showing the essential facts of the case.

IX. Applicant eligible for more than one position: The entire classified service is arranged in branches as follows: The Departmental Branch (including the Railway Mail and the Indian services), the Custom-House Branch, the Post-Office Branch, the Government Printing



A reception room in the White House, where many seekers of offices which do not come under the Civil-Service rules await the President's pleasure for an interview.

Branch, and the Internal-Revenue Branch. Subject to the restrictions of Regulation X and those hereinafter mentioned, a person may at the same time be an applicant for as many examinations in as many of the different branches of the service as he may desire, upon filing the proper applications therefor, and his name will be entered on each of the registers of eligibles secured from the examinations in which he attains an eligible average, except that no person shall at the same time be an applicant for or eligible from examination for more than one postal, customs, or internal-revenue district, or for more than one position in any postal district; but an eligible for one postal, customs, or internal-revenue district may be examined for another postal, customs, or internal-revenue district upon filing with his application for such examination a written request for the cancellation of his present eligibility for a postal, customs, or internal-revenue district, which eligibility will not be canceled, however, except upon his passing said examination: *Provided,* That the restrictions of this regulation shall not apply in cases of examinations which are held only when eligibles are needed and for which consequently it is desirable that all persons possessing the necessary qualifications should compete.

Whenever a person whose name is upon more than one register is appointed from one of such registers, his eligibility on all registers expires upon such appointment. He may, however, upon his written request at any time within the period for which eligibility would run, if not canceled by appointment, have his eligibility revived on one or more of such registers for the balance of such period.

In any branch of the service except the post-office an applicant may, if he so desires, upon filing one application and upon indicating it in his application, have his name entered upon the registers for all positions for entrance to which the same examination is given, provided he is physically qualified and within the proper age limitations. Applicants will not, however, be allowed to change the designations of the registers upon which they desire their names entered, as indicated in their applications, after the date set for the close of receipt of applications for any examination.

X. Re-examination: A person who takes an examination for the classified service will not be allowed re-examination for the same position, or for any position covered by the same examination, until approximately one year after the date of the former examination, except upon special authority of the Commission, to be granted when, in its opinion, equity or the needs of the service demand such action: *Provided,* That persons who pass or fail in any examination may, upon filing a new application, be re-examined at the corresponding examination held about one year later, though the full year may not have elapsed. In the event that they attain eligible averages in such re-examination, their names will be entered upon the register in the order of their grade, together with the other eligibles from the examination, and said entry will be treated as canceling their eligibility from the former examination. But in the event of their failing in the second examination, the eligibility from the previous examination shall continue.

Re-examinations other than those named above will be granted only in very exceptional cases, in which injustice has for any reason been done or suffered, and in such cases the request for re-examination must be accompanied by a sworn statement of the alleged facts upon which it is based. A simple statement that the applicant did not do himself justice will not be regarded as sufficient ground for allowing a re-examination. An applicant who is recovering from illness must abide by the result of his examination, whether or not he states in his declaration sheet that he is physically unable to do himself justice.

XI. Delinquency or misconduct: A person who has been separated from any branch of the service for delinquency or misconduct within one year next preceding the date of the examination selected is ineligible, and applications from such persons will be canceled. A person who fails to receive absolute appointment, after probation, to the grade for which he again applies is ineligible for re-examination for one year from the expiration of his probationary service.

XII. Vouchers: Vouchers Nos. 1 and 2 (application blank, Form 304) must be executed by citizens of the United States possessing the following requirements:

They must each be at least 21 years of age.

They must be both legal and actual bodily residents of the State in which the applicant claims legal residence.

They must have known the applicant for at least six months.

Neither of them should be the same person as the one who signs the officer's certificate or the physician's certificate.

The certificate of an officer, showing the county of which the applicant is a legal resident, must be furnished by all applicants for departmental and Government printing examinations, and the signer of it must be an officer in the county in which the applicant claims legal residence, who has an official (impression) seal, or who furnishes the certificate of the proper officer showing that he is an officer in the county entitled to a seal. A notary public or other officer in the county may be accepted on this voucher.

Vouchers will not be accepted from the father, mother, sister, brother, son, daughter, husband, or wife of the applicant, and not more than one voucher will be accepted from a relative of a more remote degree of relationship.

Applicants for the trades examinations and applicants for positions requiring professional, scientific, or technical knowledge must file supplementary statements on blanks furnished for that purpose, or in form and manner to be prescribed.

XIII. Railway Mail Clerk; height and weight: No application for the Railway Mail Service shall be approved when the applicant is shown to be less than 5 feet 4 inches in height or less than 125 pounds in weight, or is physically defective in any particular.

XIV. Government Printing Service: previous experience: No application for any one of the

mechanical trades in the Government Printing Office shall be approved unless the applicant is shown to have served at least five years at the trade for which he applies, three of which years he must have served as an apprentice and at least one year as a journeyman.

XV. Disposal of applications: All applications which are received are inspected, and if not disapproved, admission cards will be mailed to the applicants. All applications which show the applicants to be ineligible for the examinations which they seek, either on account of age, height, weight, citizenship, delinquency, or misconduct while in the service, or for other reasons, will be disapproved and retained in the files of the Commission. All applications which are defective in their execution, and can be corrected by the applicant, will be returned for correction, but an application which has been twice returned for correction and is still found to be incomplete or incorrect will be disapproved.

XVI. Applications part of Commission's records: Applications which have been approved or disapproved and all examination papers of competitors form parts of the official records of the Commission, and can not, under any circumstances, be returned to the applicants or competitors.

POSITIONS EXCEPTED FROM COMPETITIVE EXAMINATION.

1. *Post-office service.*—All positions in classified post-offices are filled through examination and certification except the following:

(*a*) *Not exceeding one private secretary or confidential clerk to the postmaster, if authorized by the Postmaster General, at each post-office where the receipts of the last preceding fiscal year amounted to as much as $350,000.*

(*b*) *One assistant postmaster or the chief assistant to the postmaster, of whatever designation, at each post-office.*

(*c*) *Not exceeding one auditor at the post-office at New York City.*



Department of State, Washington, D. C. Here are managed the affairs of State, under the general direction of our Secretary of State, John Hay. Many thousand civil service employees are here given employment.

(*d*) *Not exceeding one finance clerk, if authorized by law and regularly and actually assigned to act as auditor, at each post-office where the receipts for the last preceding fiscal year amounted to as much as $350,000.*

(*e*) *Not exceeding one cashier or finance clerk at each first-class post-office.*

(*f*) *Not exceeding one cashier and one finance clerk at each post-office where the receipts for the last preceding fiscal year amounted to as much as $500,000.*

(*g*) *Not exceeding one cashier and two finance clerks at each post-office where the receipts for*

the last preceding fiscal year amounted to as much as $1,000,000.

(h) Not exceeding one cashier and three finance clerks at each post-office where the receipts for the last preceding fiscal year amounted to as much as $2,000,000.

(i) Not exceeding one clerk, who shall be a regular physician, at each first-class post-office, when authorized by the Postmaster General, to examine applications for sick leave, and also to act as a general utility clerk.

2. *Custom-house service.*—The list of positions excepted from competitive examination in the custom-house service is as follows:

(a) Not exceeding one cashier in each customs district, if authorized by the Secretary of the Treasury.

(b) Not exceeding one chief or principal deputy or assistant collector at each customs port; and not exceeding one principal deputy collector of customs at each subport or station.

(c) Not exceeding one deputy naval officer at each customs port where a naval officer is authorized by law.

(d) Not exceeding one deputy surveyor of customs at each customs port where a surveyor is authorized by law.

(e) Not exceeding one private secretary or confidential clerk, if authorized by the Secretary of the Treasury, to the collector of each customs district where the receipts for the last preceding fiscal year amounted to as much as $500,000.

(f) Not exceeding one private secretary or confidential clerk, if authorized by the Secretary of the Treasury, to each of the appraisers at the ports of Boston, New York, and Philadelphia, respectively.

(g) Not exceeding one counsel before the Board of United States General Appraisers.

(h) Not exceeding one paymaster in the New York customs district.

(i) All positions in Alaska.

Appointments to the positions named in this rule under *a, b, c,* and *d,* in the custom-house service, shall be subject to an examination to be prescribed by the Secretary of the Treasury, not disapproved by the Commission, equivalent to the examination held by the Commission for positions of like grade. Such examination shall be conducted by the Commission in accordance with its regulations: *Provided,* That examinations may be waived by the Secretary of the Treasury for appointments in the Alaska customs service.

For information in regard to any of the above-named positions, applicants should apply to the Postmaster General or the Secretary of the Treasury, as the case may be.

ELIGIBILITY AND APPOINTMENT.

It is necessary to obtain a general average of 70 per cent to be eligible for appointment, except that applicants entitled to preference under section 1754, United States Revised Statutes, because of honorable discharge from the military or naval service for disability resulting from wounds or sickness incurred in the line of duty, need obtain but 65 per cent. The relative standing of persons on any particular register may be changed by the addition of names of persons with higher standings. The grade obtained, and not the date of the examination, determines the position of a name upon the register. An eligible will upon proper request in person or by letter or by authorized representative be informed of his or her relative standing on the register, except on the assistant microscopist, observer, tagger, stock examiner, and meat inspector registers, which, at the request of the Agricultural Department, are closed registers.

Every competitor in an examination comprising both grade subjects and technical subjects must pass with an average of at least 70 per cent on the technical subjects in addition to attaining an eligible grade on the whole examination, in order to become eligible for appointment. Should a competitor fail to obtain an average of at least 70 per cent on the technical subjects, the grade subjects will not be rated unless such grade subjects be of the first grade and constitute a complete examination in themselves, in which case they may be rated independently of the technical subjects, if so requested by the competitor in his application, and if an eligible average is attained his name may be entered upon the departmental clerk register.

WHEN PERIOD OF ELIGIBILITY BEGINS AND ENDS.

The period of eligibility on all registers for original appointment to the service is one year from the date of entering the name on the register, which entry is made as soon as practicable after the completion of the marking of the papers. The date of entry of a name on the register is usually but a few days subsequent to the date of the notice of eligibility. The period of eligibility may, however, be extended in the discretion of the Commission for a further period of one year from the date of the expiration of the first year's eligibility upon such conditions as the Commission may prescribe. The extension of the period of eligibility can not be granted in individual cases, however, and is allowed only in the discretion of the Commission when the needs of the service require it, and then must be extended to the entire list of eligibles on the particular register to which applied. In case a person whose name is upon any register shall be mustered into the military or naval service of the United States at a time when the United States may be engaged in war the period of eligibility of such person shall, under such conditions as the Commission may prescribe, be considered as suspended during the time that such eligible may be serving in the Army or Navy of the United States.

METHODS OF CERTIFICATION.

Until requested to certify names for filling a vacancy, the Commission has no information in regard to any vacancy which may exist in any branch of the service. Whenever a vacancy exists, the appointing officer makes requisition upon the Civil Service Commission for a certification of names to fill the vacancy, specifying the kind of position vacant, the sex desired, and the salary. Upon receipt of such requisition the Commission takes from the proper register of eligibles the names of the *three* persons standing highest of the sex called for, and certifies them to the appointing officer, who is required to select one of

the three certified to fill the vacancy. The appointing officer may select any one of the three names. The two remaining names are returned to the register to await further certification. The time of examination is not considered in making certifications, as the highest in grade on the register must be certified first, although they may not have been the first examined. No eligible can be certified for appointment more than three times to the same department or office, but may be certified three times to each of the Executive Departments, if reached for such certifications during the year of eligibility. It will be seen that efforts to expedite certification or to secure certification out of the order required by law, rules, or the Commission's regulations can not possibly be of any avail. The Commission has absolutely no power to certify a name out of its order or to withhold a name from certification when reached.



General Postoffice, Philadelphia. Extending on Ninth street from Chestnut to Market.

DEPARTMENTS AND THEIR EXAMINATIONS.

NOTE.—The general scholastic subjects of many examinations, such as spelling, arithmetic, letter writing, and copying from plain copy, are of three grades or degrees of difficulty, known as first, second, and third grades—the first grade being the most difficult and the third grade the least difficult. These subjects are designated under the different examinations as "grade subjects." In the descriptions of examinations comprising any of these subjects reference will be made to the particular grade of the subject comprised. In addition to these subjects, the subject of copying from rough draft is included in the first grade and the subject of geography in the second grade.

FIRST GRADE SUBJECTS.

1. *Spelling:* Twenty words slightly above average difficulty. 2. *Arithmetic:* Fundamental rules, fractions, percentage, interest, discount, analysis, and statement of simple accounts. 3. *Letter writing:* Test in the use of the English language for business correspondence. 4. *Penmanship:* Marked on legibility, rapidity, neatness, and general appearance. 5. *Copying from plain copy:* An exact written copy of a few printed lines. 6. *Copying from rough draft:* Draft of manuscript with interlineations, erasures, misspelled words, errors in syntax, etc., of which a smooth corrected copy is to be made.

The following questions and tests indicate the general character of these subjects:

SPELLING.

Spelling is dictated by the examiner. The words are written by the competitor in the blank spaces indicated on the first sheet of the examina-

tion. All words should be commenced with capital letters. The examiner pronounces each word and gives its definition as printed below. The competitor is required to write only the word and not its definition.

Ginger: The root of a medicinal plant. *Certificate:* A written testimony; as, a certificate of stock. *Promissory:* Containing a promise; as, a promissory note. *Seizing:* Taking suddenly. *Zinc:* A whitish metal. *Adjacent:* Lying near or bordering on. *Properly:* In a proper or right manner. *Schenectady:* A city of the United States. *Opportunity:* A fit or convenient time.



Independence Hall, Philadelphia.

Insertion: The act of placing in; as, the insertion of an advertisement. *Usage:* Custom in using; as, commercial usage. *Facilitate:* To make easy; as, to facilitate business. *Legible:* Capable of being read; as, a legible signature. *California:* One of the United States. *Flannel:* A soft woolen cloth of loose texture. *Business:* Occupation or trade. *Handkerchief:* A piece of cloth for wiping the face or nose. *Strychnine:* A powerful poison. *Concede:* To give up; to yield; as, to concede a point. *Souvenir:* A token of remembrance; a keepsake.

ARITHMETIC.

In solving problems the processes should be not merely indicated, but all the figures necessary in solving each problem should be given in full. The answer to each problem should be indicated by writing "Ans." after it.

1. This question comprises a test in adding numbers crosswise and lengthwise. There are usually three columns of about twelve numbers each to be added. **2.** Divide 47 3/25 by 7 3/5, multiply the quotient by 3 4/5, and to the product add 0.0907 of 214.6. **3.** A grocer sold goods to a customer, amounting to $352, by weights averaging 15¼ ounces to the pound. He afterwards sold to the same customer goods amounting to $320, by weights averaging 16½ ounces to the pound. How much did the grocer make or lose by the false weights? **4.** The appropriation for the Civil Service Commission for the fiscal year ended June 30, 1897, was $98,340. During that year 50,000 persons were examined. If 34 per cent of this number failed to pass, and 17½ per cent of those who passed were appointed, what was the average cost to the Government of each appointment? **5.** On December 1, 1900, Thomas Hammond, a commission merchant, owed James Wilson an account of $343.75. December 3 Wilson shipped Hammond 8,500 pounds of pork, which he sold at 12 cents per pound, charging ½ per cent commission. December 7 Hammond sold Wilson 80 head of cattle, total weight 105,960 pounds, at $4.25 per 100 pounds. December 14 Hammond sold for Wilson 1,800 bushels of wheat

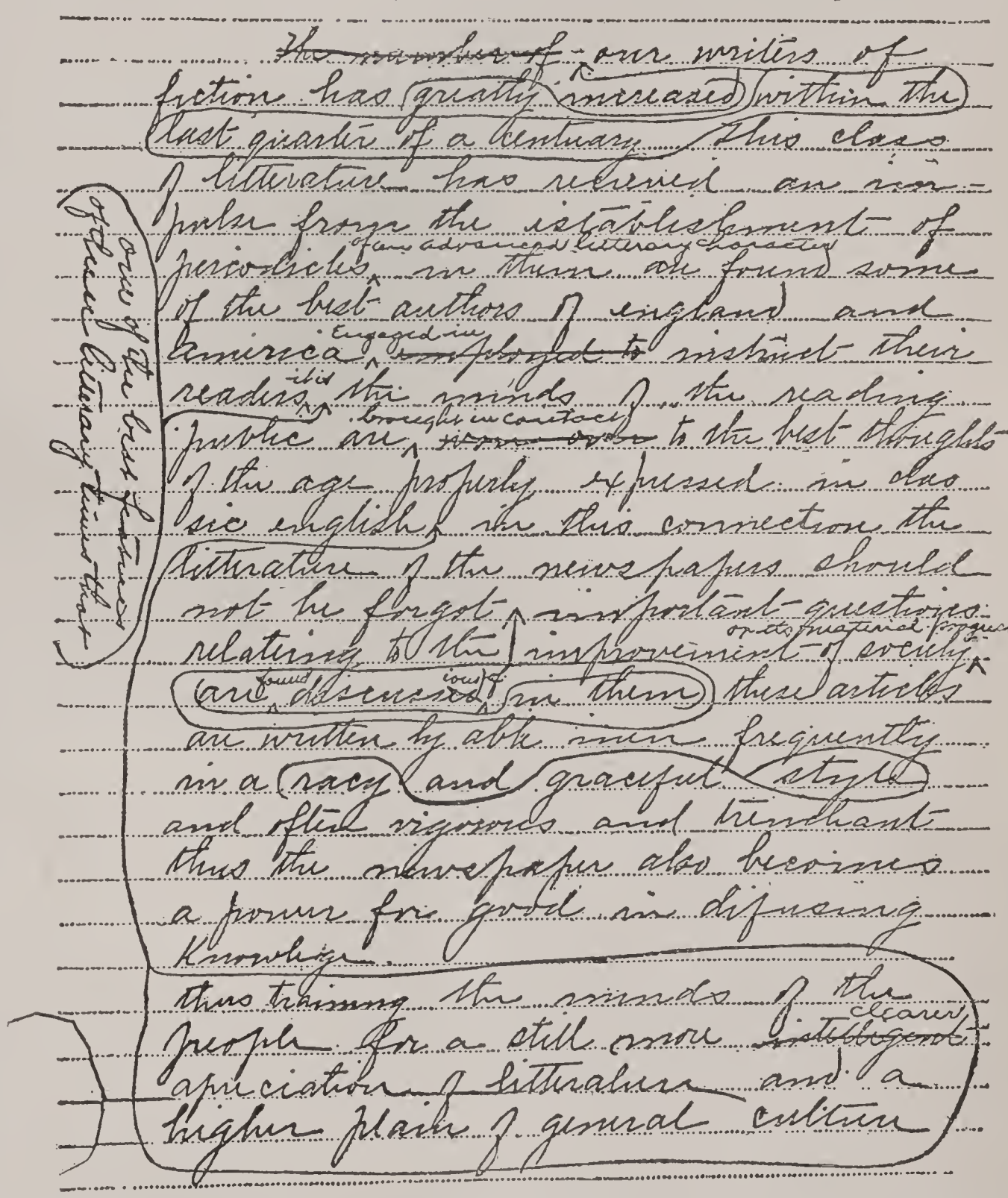
at 75 cents per bushel, charging him 1 per cent commission and $25 for storage. December 26 Wilson bought of Hammond 128,600 feet of lumber, at $3.25 per 1,000 feet. December 27 Hammond received from Wilson a note for $1,250, due in 60 days. December 29 Wilson paid a draft drawn on him by Hammond for $460. Make an itemized statement of the above account as it should appear taken from the books of Wilson; make a proper heading, close the account, and bring down the balance as it should appear January 1, 1901.

FIRST GRADE.

SIXTH SUBJECT.—*Copying from rough draft.*

N. B.—Spelling, use of capitals, and all omissions and mistakes will be taken into consideration in marking this subject.

Directions to the competitor.—Write on the accompanying blank sheet a smooth copy of the manuscript on this sheet. Make such changes only as are necessary to correct errors in syntax, orthography, punctuation and capitalization, and to write in full abbreviated words. Paraphrasing and the insertion or omission of words which does not improve the text are not permitted.



LETTER WRITING.

The competitor is permitted to write on either one of two subjects given. The following subject has been used: Write a letter of not less than 150 words giving your views as to the advantages and disadvantages of employment in the departmental service in Washington.

This exercise is designed to test the competitor's knowledge of simple English composition and his general intelligence. In marking the letter, its errors in form and address, in spelling, capitals, punctuation, syntax, and style, and its treatment of the subject are considered.

PENMANSHIP.

The mark on penmanship will be determined by legibility, rapidity, neatness, and general appearance, and by correctness and uniformity in the formation of words, letters, and punctuation marks in the exercise of the fifth subject—copying from plain copy. No particular style of penmanship is preferred.

COPYING FROM PLAIN COPY.

N. B.—Paragraph, spell, capitalize, and punctuate precisely as in the copy. All omissions and mistakes will be considered in marking this subject.

Make an exact written copy of the following:

The civil service act has also limited the power of removal by providing that no person serving in any department or office shall be removed because of his refusal (1) to contribute for a political purpose, or to render political service; or (2) to permit the appointing officer, or any other person in the service, to coerce his political action. The object of Congress in thus limiting the power of appointment and removal was manifestly to divorce the subordinate offices of the Government from politics and elections. The law provides that open, competitive examinations shall be held by the Commission; that these examinations shall be practical in their character, and, so far as may be, shall relate to those matters which

will fairly test the relative capacity and fitness of the persons examined to discharge the duties of the places to which they seek appointment. (Fourth Report, page 139.)

SECOND GRADE SUBJECTS.

1. *Spelling:* Twenty words of average difficulty in common use. 2. *Arithmetic:* Embraces addition, subtraction, multiplication, and division of whole numbers, and common and decimal fractions. 3. *Letter writing:* Test in the use of the English language for business correspondence. 4. *Penmanship:* Marked on legibility, rapidity, neatness, and general appearance. 5. *Copying from plain copy:* An exact copy of a few printed lines, in competitor's handwriting. 6. *Geography of the United States.*



Experienced distributers sorting mail in the Postoffice Department.

The following questions and tests indicate the general character of these subjects:

SPELLING.

Spelling is dictated by the examiner. The words are written by the competitor in the blank spaces indicated on the first sheet of the examination. All words should be commenced with capital letters. The examiner pronounces each word and gives its definition. The competitor is required to write only the word and not its definition.

Manual: Done with the hands; as, manual labor. *Newspaper:* A printed paper that gives the news. *Exceed:* To surpass or go beyond; as, to exceed one's authority. *Eighth:* Next in order after seventh. *Wisconsin:* One of the United States. *Vehicle:* That in which anything may be carried. *Peaceable:* Gentle or peaceful. *Eager:* Keenly desirous; as, eager to go. *Cellar:* A storeroom under a house. *Delicate:* Very nice; as, a delicate flower. *Assign:* To set apart; as, to assign to duty. *Conceal:* To hide or secrete; as, to conceal valuables. *Minute:* The sixtieth part of an hour. *Benefit:* Advantage or profit. *Awning:* A cover spread for shade. *Forward:* To send toward a destination; as, to forward mail. *Withhold:* To hold back; as, to withhold one's pay. *Diligent:* Busy or active; as, a diligent clerk. *Offered:* Presented for acceptance or rejection. *Station:* A stopping place; as, a railway station.

ARITHMETIC.

In solving problems the processes should be not merely indicated, but all the figures necessary in solving each problem should be given in full. The answer to each problem should be indicated by writing "Ans." after it.

1. Add the following, and from the sum subtract 32,885,696 (here will be given a short column of figures). **2.** Multiply 7 2/25 by 36.8, and divide the product by 1.92. Solve by decimals. **3.** A carrier can assort 43 letters or 37 papers in a minute. At this rate, how many hours will it take him to assort 3,655 letters and 185 pounds of papers, averaging 7 papers to the pound? **4.** A lot which was 53 feet wide and 150 feet long sold for $8,347.50, which was one-fourth more than it cost. What was the cost per square foot? **5.** In a certain mail there are 294 pounds 14 ounces of newspapers weighing at the rate of 3 papers to every 7 ounces. How many papers are there in the mail? 16 ounces = 1 pound.

LETTER WRITING.

The competitor is permitted to write on either one of two subjects given. The following subject has been used:

Write a letter of not less than 125 words giving your views as to the advantages derived from free

public libraries in the principal cities of your State. This exercise is designed chiefly to test the competitor's skill in simple English composition. In marking the letter, its errors in form, and address, in spelling, capitalization, punctuation, syntax, and style, and its adherence to the subject will be considered.

PENMANSHIP.

The mark on penmanship will be determined by legibility, rapidity, neatness, and general appearance, and by correctness and uniformity in the formation of words, letters, and punctuation marks in the exercise of the fifth subject—copying from plain copy. No particular style of penmanship is preferred.

COPYING FROM PLAIN COPY.

N. B.—Paragraph, spell, capitalize, and punctuate precisely as in the copy. All omissions and mistakes will be taken into consideration in marking this subject.

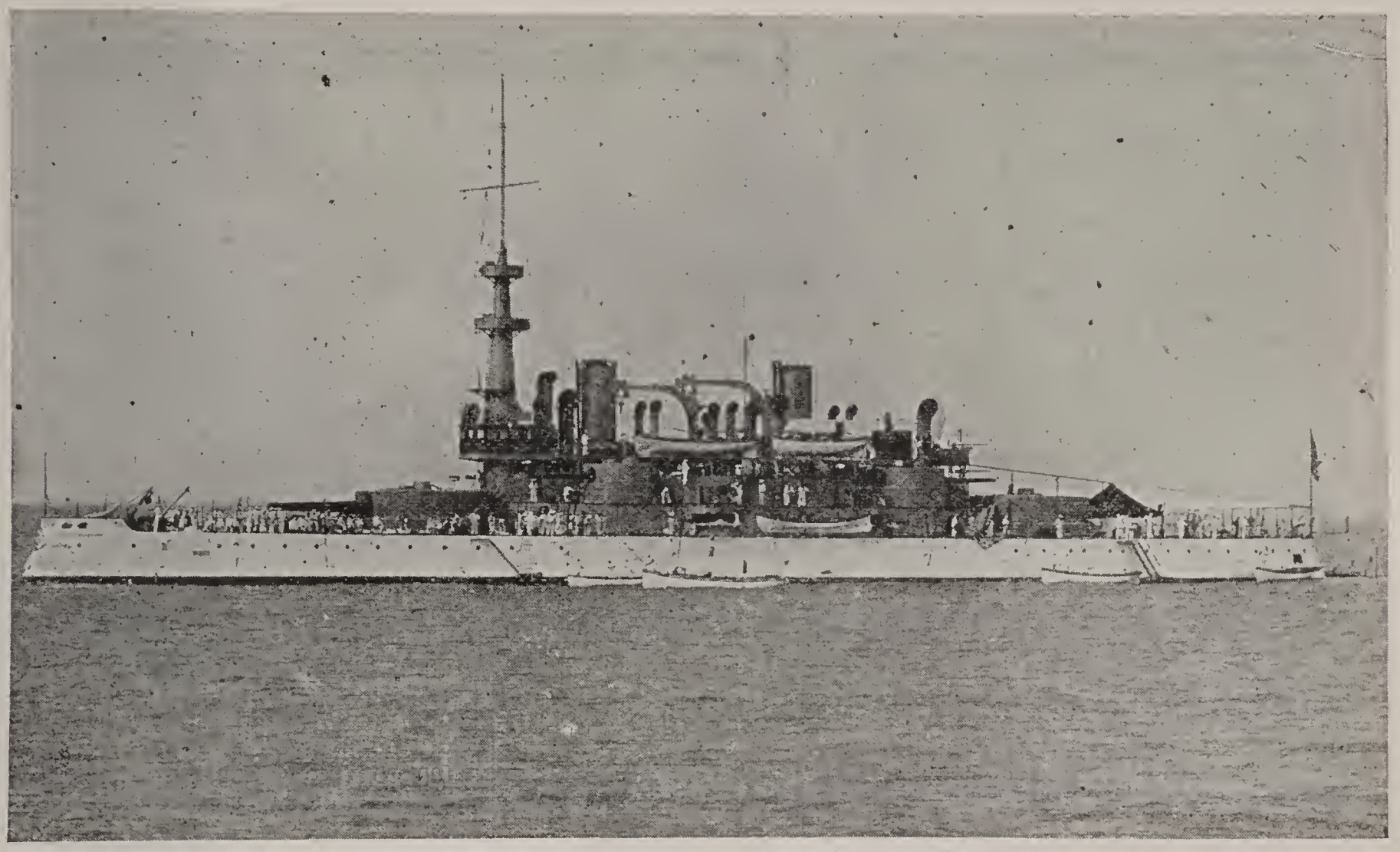
Make an exact written copy of the following:

No recommendation of an applicant, competitor, or eligible, involving any disclosure of his political or religious opinions or affiliations, shall be received, filed, or considered, by the Commission, by any board of examiners, or by any nominating or appointing officer. In making removals or reductions, or in imposing punishment for delinquency or misconduct, penalties like in character shall be imposed for like offenses, and action thereupon shall be taken irrespective of the political or religious opinions or affiliations of the offenders. A person holding a position on the date said position is classified under the civil service act shall be entitled to all the rights and benefits possessed by persons of the same class or grade appointed upon examination under the provisions of said act.

GEOGRAPHY OF THE UNITED STATES.

N. B.—Competitors are cautioned not to exceed the requirements of the questions in their answers, as no credit will be given for additional information.

1. Name States as follows: One which borders Alabama on the north; one which borders New Hampshire on the east; one which borders New Mexico on the north; one which borders Indiana on the west; one which borders Pennsylvania on the north. 2. Name the largest city in Rhode Island; the largest city in Oregon; the capital of Louisiana; the capital of Nebraska; the capital of West Virginia. 3. Name a river and another large body of water which border on each of the following-named States: Wisconsin, Maryland, Washington, Vermont, Texas. 4. Name the river or body of water on which each of the following-named important cities is situated: Louisville, Buffalo, Duluth, Hartford,



UNITED STATES BATTLESHIP OREGON

Twin screw; lenghth, 348 feet; breadth, 69 feet 3 inches; draft, 24 feet; displacement, 10,288 tons; speed, 16.79 knots. Main battery, four 13-inch, eight 8-inch and four 6-inch breech loading rifles. Secondary battery, twenty 6-pounder and six 1-pounder rapid-fire guns, and four gatlings. Armor on sides, 18 inches. 32 Officers, 441 Men. Cost, $3,180,000.

Vicksburg. 5. In what State or Territory is each of the following-named prominent cities located: Worcester, Phœnix, Key West, Sioux Falls, Camden, Asheville, Utica, Saginaw, Rutland, Dubuque.

THIRD GRADE SUBJECTS.

1. *Spelling:* Twenty simple words in ordinary use. 2. *Arithmetic:* Embraces addition, subtraction, multiplication, and division of whole numbers and of United States money. 3. *Letter writing:* Test in the use of the English language for business correspondence. 4. *Penmanship:* Marked on legibility, rapidity, neatness, and general appearance. 5. *Copying from plain copy:* An exact copy of a few printed lines, in competitor's handwriting.



A great feat of civil engineering. A drainage canal cut through solid rock.

The following questions and tests indicate the general character of these subjects:

SPELLING.

Spelling is dictated by the examiner. The words are written by the competitor in the blank spaces indicated on the first sheet of the examination. All words should be commenced with capital letters. The examiner pronounces each word and gives its definition. The competitor is required to write only the word and not its definition.

Sugar: A sweet substance made from the juice of the sugar cane. *Pledge:* Something given as security. *Cashier:* One who has charge of money in a bank. *Figure:* A mark representing a number. *Carrying:* Conveying or transporting in any way. *Breadth:* The measure from side to side. *Sheet:* The amount of paper made in one body or piece; as, a sheet of paper. *Easily:* In an easy manner. *Frontier:* The border or limits of a country. *Patience:* The habit of being patient. *Guess:* The act of guessing; as, to guess at one's weight. *Threat:* The act of threatening; as, to make a threat. *Diamond:* A precious gem. *Visit:* To go to see; as, to visit a friend. *Repair:* To mend or make over; as, to repair clothes. *People:* The body of persons composing a nation; as, the American people. *Require:* To be in need of; as, to require money. *Grease:* Soft animal fat. *Answer:* To reply to; as, to answer a letter. *Exist:* To live; as, to exist in poverty.

ARITHMETIC.

In solving problems the processes should be not merely indicated but all the figures necessary in solving each problem should be given in full. The answer to each problem should be indicated by writing "Ans." after it.

1. (This question will consist of a short column of figures to be added.) **2.** Divide 2,408,588 by 4,732. **3.** Multiply 8,643 by 608, and then subtract 98,746. **4.** A merchant who spent $225, bought 65 pounds of butter at 30 cents per pound, 84 barrels of apples at $2.25 per barrel, and spent the remainder for coffee. How much did he spend for coffee? **5.** During the month of August 450,000 bushels of wheat were shipped from a certain port. During September 87,960 more bushels were shipped than during August. What was the total number of bushels shipped in the two months?

LETTER WRITING.

The competitor is permitted to write on either one of two subjects given. The following subject has been used:

Write a letter containing not less than 100 words stating some of the advantages now derived by mankind from the art of printing. This exercise is designed chiefly to test the competitor's skill in simple English composition. In marking the letter, its errors in form and address, in spelling, capitalization, punctuation, syntax, and style, and its adherence to the subject, will be considered.

PENMANSHIP.

The marks on penmanship will be determined by legibility, rapidity, neatness, and general appearance, and by correctness and uniformity in the formation of words, letters, and punctuation marks in the exercise of the fourth subject—

copying from plain copy. No particular style of penmanship is preferred.

COPYING.

N. B.—Paragraph, spell, capitalize, and punctuate as in the copy. All omissions and mistakes will be taken into consideration in marking this subject.

Make an exact written copy of the following:

The present postal policy is to carry newspapers in some cases free, and in all other cases at much lower rates of postage than is charged for letters; the one being for the public weal, while the other is for private benefit. If the telegraph



Government experts gathering information concerning ship-wrecks at sea. The diver is preparing to descend.

becomes a part of the service it will still be the duty of the Department to transmit telegrams for the press at much lower rates than for private individuals.

MISCELLANEOUS EXAMINATION QUESTIONS.

Selected to show the educational requirements of various branches of the service.

PRACTICE OF BOOKKEEPING.

The first exercise is given a weight of 2, and the second exercise a weight of 1.

FIRST EXERCISE.

Instructions.—On the blanks furnished make the necessary journal entries for the transactions found in the memoranda below. Keep bank account separate from the cash account. Make no daybook entries.

August 2, 1897, James Worley began business with the following resources: Store building and lot, $4,250; cash in Market Bank $1,750, in safe $357.28; Wilton & Co.'s note for $658.50, dated July 28, due 10 days after date. Liabilities were as follows: Account in favor of John R. Steeves for $450; note for $1,893.75 in favor of E. P. Coleman, dated July 20, due 60 days after date, with interest at 6 per cent, interest accrued to date, $4.10.

August 4. Bought with check 10 shares Market Bank stock at 69. (Par value, $100.)

August 6. Bought of Graber Bros. merchandise worth $3,875. Gave in payment check for $400, balance on account.

August 7. Wilton & Co.'s note for $658.50 (mentioned in resources) has been protested for nonpayment. Protest fee, $1.65.

August 10. Sold J. Lovell Newell merchandise valued at $3,134.27. Received in payment at its present worth my note for $1,893.75 favor E. P. Coleman (mentioned in liabilities), present worth $1,900.38, balance on account.

August 12. Drew a sight draft on J. Lovell Newell for $325 and remitted it to Graber Bros. on account.

August 13. Sold to Abner Smith 10 shares Market Bank stock at 71 and received his check on Market Bank for amount.

August 14. Received of J. Lovell Newell on account his draft at 30 days' sight on E. P. Coleman for $560. Presented above draft for acceptance and Coleman has accepted same payable at Market Bank.

August 14. Due W. H. McCord $50 salary for one-half month. Paid W. H. McCord one-half the amount due him in cash.

August 16. Discounted at 8 per cent my note for $1,800 given for 60 days at Market Bank and received credit for proceeds. Discount, $25.20.

SECOND EXERCISE.

From the data given below make out a balance sheet.

On August 31, 1897, James Corbin and John Smith, under the firm name of Corbin & Smith, had on hand as per inventory the following: Merchandise, $2,405; real estate, $7,800; stationery, $12.50. The footings of the accounts in their ledger were as follows:

Debit footings—James Corbin (member of firm), $260; cash, $2,875.25; Hartford Bank, $2,989; real estate, $7,500; merchandise, $6,650.89; bills receivable, $2,689; bills payable, $975.80; expense, $167.50; interest and discount, $40.78; Levi Williams, $900.

Credit footings—James Corbin (member of firm), $6,567.44; John Smith (member of firm), $7,897.50; cash, $1,297.28; Hartford Bank, $897.75; merchandise, $5,489.80; bills receivable, $1,600; bills payable, $1,275.80; interest and discount, $22.65.

GEOGRAPHY.

1. Name States as follows: Two that border on both the Ohio and Mississippi rivers; two that border on both the Pacific Ocean and Columbia River; two that border on both the Atlantic Ocean and Potomac River; two that border on Lake Champlain; two that border on both the Gulf of Mexico and Mississippi River. **2.** Name the largest lake port or seaport in each of the following-named States, and give the body of water on which each port named is situated: Minnesota, Pennsylvania, Texas, California, Maine. **3.** Name the river or body of water into which each of the following-named rivers flows: Niagara, Arkansas, Connecticut, Detroit, Lewis (or Snake). **4.** Name the river or body of water on which each of the following-named prominent cities is situated: Memphis, Evansville, Hartford,



Chain and bucket cantilever at work on the Chicago Drainage and Ship Canal. This canal has reversed the flow of the Chicago River, which is now an outlet for the water from Lake Michigan into the Gulf of Mexico. It is 34 miles long, 202 feet wide at the bottom and 306 feet at the top, and has a water depth of about 25 feet.

Council Bluffs, Toledo, Milwaukee, Seattle, Mobile, Buffalo, Trenton. **5.** Name five States that border on the Mississippi River, and give the capital of each State required.

FARM ECONOMY.

1. Name all the tools and materials necessary, and describe fully the method of using them, in the construction of a substantial barbed wire fence. **2.** Describe the essential parts of a threshing machine for threshing small grain, and explain its mode of operation. **3.** Name two kinds of timber most suitable for each of the following uses: House or barn sills, shingles, fence posts, house flooring, bending work. **4.** Describe in detail the various essential parts of a common lifting pump, and state the principle of its operation. **5.** Define each of the following terms as ap-

plied to farm implements, etc.: Doubletree, tugs, moldboard, kingbolt, felloe.

GRAMMAR.

For myself I can truly say that the strongest and most abiding incentive to excellence by which I was ever animated sprang from that look of solicitude and hope, that heavenly expression of maternal tenderness, when, without the utterance of a single word, my mother has looked into my face, and silently told me that my life was freighted with a two-fold being, for it bore her destiny as well as my own.—*Horace Mann.*

The first seven questions refer to the above selection.

1. Classify the following clauses: (a) "incentive sprang" (line 2); (b) "mother has looked" (line 4); (c) "it bore" (line 6).

2. Give five modifiers of "incentive" (line 2).

3. Give two modifiers of "looked" (line 4), and three of "told" (line 5).

4. Parse "abiding" (line 1).

5. (a) Give the mode and tense of each verb in the above selection. Which are (b) transitive; (c) intransitive? (d) Which are used in the passive voice?

6. What part of speech is each of the following: (a) "for" (line 1); (b) "that" (line 1); (c) "most" (line 1); (d) "that" (line 2); (e) "for" (line 6).

7. Define (a) common noun; (b) abstract noun. Give an example of each.

8. Write a sentence whose subject is (a) an infinitive; (b) a clause.

METHODS OF MANUAL TRAINING.

N. B.—In marking the essays, style or manner of expression, together with adherence to and treatment of the subject given, will be considered.

Write a brief essay on each of the following topics: **1.** A brief description of the tools, appliances, and accommodations necessary for the instruction of a class of ten pupils in woodworking. **2.** Describe fully the details of a lesson in nailing. **3.** Describe fully the details of a lesson on the use of the file in metal working.

INDUSTRIAL ECONOMY.

1. Describe fully all the essential parts of a turning lathe for woodwork, and explain fully how to use it. **2.** Describe fully how to sharpen and adjust a jack plane for soft wood. **3.** Describe fully the process of making and setting a wagon tire. **4.** Describe the special properties and name two important industrial uses of each of the following: Steel, copper, zinc, lead, graphite.



Blasting rock on the Chicago Drainage Canal. This canal will cost over 80 million dollars when completed, and has furnished many years of employment for many United States Government and City of Chicago civil service applicants.

5. Describe fully the process of joining wood by means of glue.

INDUSTRIAL DRAWING.

Design and make complete working drawings showing all the details of the construction of a simple wooden mantel. Make drawings to a scale of three-fourths inch to the foot.

FREE-HAND DRAWING.

1. Make a sketch of a stepladder having six steps and a platform at the top. **2.** Make a copy of a given design, enlarging it one and one-half times. **3.** Make a copy of a given picture, enlarging it one and one-half times.

DRAWING.

These questions afford opportunity to show more or less knowledge, skill and imagination. Graphic answers are preferred to verbal. Any

medium may be used, as pencil, water color or clay. Every sketch should be in itself pictorial and decorative as well as representative; this may be attained by artistic handling and placing on the paper.

1. Draw in bold outline from memory or nature some flower and leaf form, and

2. Use this as material for architectural ornament to fill a tympanum four inches in diameter.

3. Draw a border in the Greek style, introducing the Anthemion, and color, or indicate what was the historic coloring.

4. Make from memory or object a free-hand sketch for working drawings of a hand-wrench, such as is used for a bicycle, indicating dimensions; and

5. Make working drawings for three threads of the screw on a scale of 2 inches to 1 foot.

6. Make in a rectangle, 9 inches by 4 inches, a perspective sketch in light and shade or color, of thumb marks? In what would you model a light scroll ornament for a key-escutcheon to be cast in brass?

10. Draw a chair as you see it. Put a cube in (mechanical) angular perspective at angle of 30 degrees and 60 degrees to the picture plane, showing construction.

Typical of questions in Patent Office examination. Name the parts indicated and their uses.

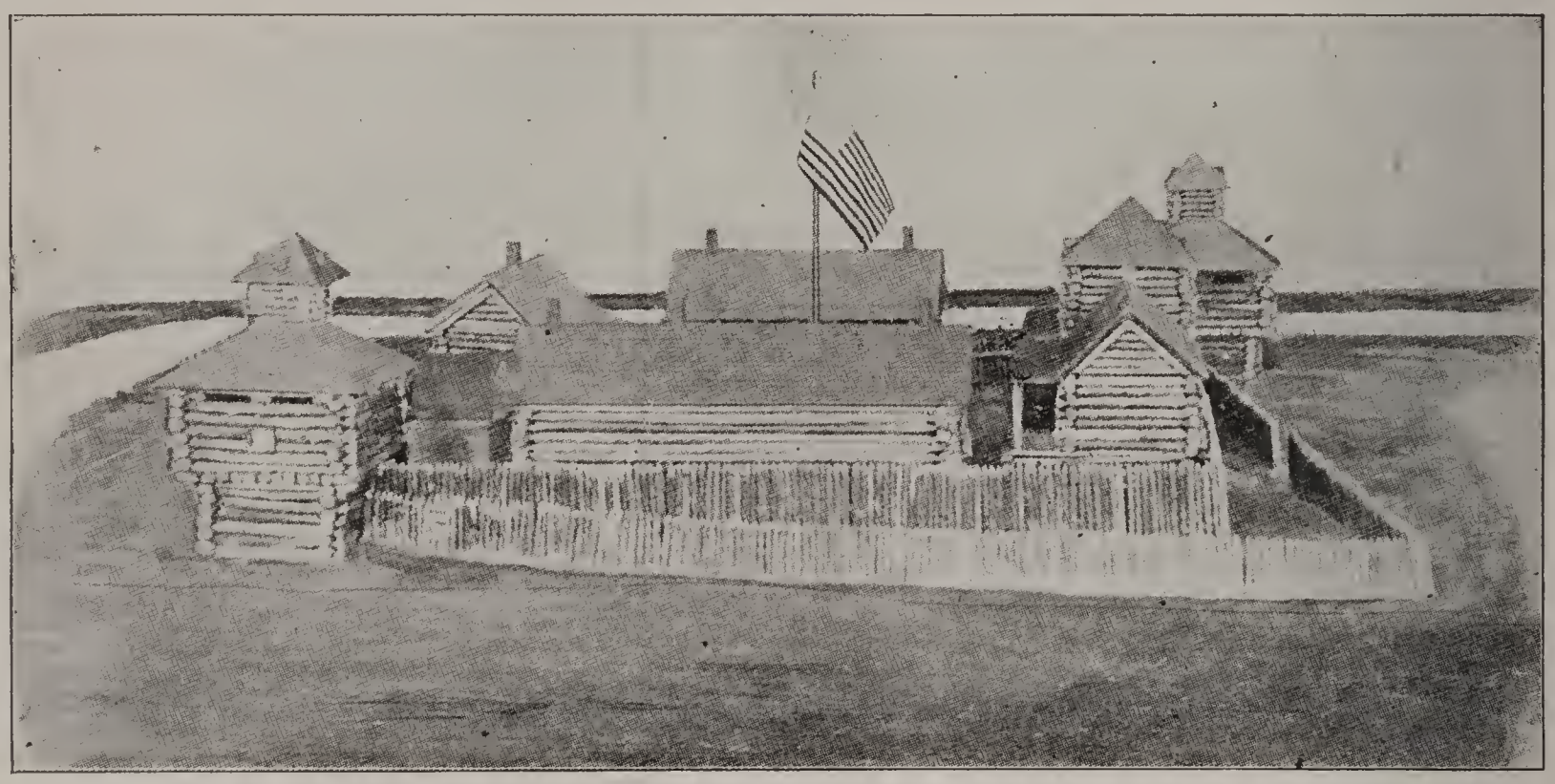
ARCHITECTURAL DESIGN.

1. *Practical and theoretical questions and drawings.*

1. Under what circumstances are the following scales used in making drawings: ⅛ scale, ¼ scale; 1 in. scale; full size.

2. What are the conventional colors used on drawings to show different materials? What other method is there? Describe same.

3. Describe a bearing wall in contradistinction to a non-bearing wall.



Ft. Dearborn in 1808. This fort was located at the mouth of the Chicago River. This was the beginning of the City of Chicago 100 years ago, now the great industrial center of two million inhabitants.

a lodge having a cylindrical tower with conical roof; the lodge having also a round-arched entrance to the grounds beyond.

7. Draw with instruments a rose window with quatre-foil tracery, four inches in diameter.

8. Which of the Greek orders has a column without a base? Which was most used by the Romans? What architectural style is suggested by the description of the lodge in No. 6? What method of roofing caused the development of Gothic architecture? What style of architecture is alive in France to-day? To what style is the rose window of No. 7 appropriate? If the body of a design is in salmon pink, what is the background color if a complementary is used? What is a triglyph; an entasis; an ogee curve?

9. If a terra cotta moulding is to be made, can a metal frame-work be used? In what would you model it, and what would be the shrinkage? In modeled ornament do you prefer to see tool or

4. Describe fire-proof construction in contradistinction to non-fire-proof construction.

5. Name the different kinds of bottoms for foundations in the order of their desirability.

6. How should a rock bottom (sloping) be prepared?

7. Describe the various ways of carrying the weight over openings in walls.

8. Describe bonding in brick piers.

9. Describe the various methods of preventing dampness penetrating walls.

10. How much bearing on a wall should a wooden beam have? A wooden girder? An iron beam?

11. Describe the principal methods of rendering iron work fire-proof.

12. Describe the principal kinds of fire-proof floors. Make a free hand sketch of each.

13. State the safe carrying capacity per sq. foot of (a) concrete (Portland); (b) brick work

(Rosendale); (c) brick work (Lime); (d) limestone (Indiana); (e) North River blue stone; (f) spruce; (g) yellow pine.

14. State the weight per cubic foot for the following: (a) concrete; (b) brick work; (c) spruce; (d) yellow pine.

15. What are the superimposed loads to be allowed for the following floors: (a) sidewalk; (b) meeting room; (c) dwelling; (d) offices; (e) warehouse; (f) stable; (g) roofs.

16. Give the methods of calculating the strength of a wooden floor beam, with example.

17. What are the ordinary weights per sq. foot of the following floor constructions: (a) wooden floors; (b) deafened floors; (c) fire-proof floors; giving weights in detail.

Drawings—Note: Drawings should be made to a scale to fit the paper.

18. Name the five orders of architecture. State the height of the column in each order, expressed in diameters. Make a free hand sketch of the capital in each order.

19. Make a drawing of a classic pediment, showing the method of determining the slope.

20. Make a drawing of the entablature of the Corinthian order; elevation and section.

21. Make a drawing of an Italian renaissance pilaster, with cap and base,

22. Make a drawing for a steel girder and cast iron column connection showing bracket, lug, etc.

23. Make a drawing of the section of a box window frame.

24. Make a complete sectional drawing, showing the proper thickness of the wall for each story, footings, etc., of the front bearing wall of a four-story building with cellar. The floor load to be taken at 150 lbs. per sq. foot, with a clear span of 20 feet. The wall to be faced with 8 in. stone ashlar for first story and pressed brick for the upper stories. The cellar wall of brick; the bottom is hard pan. The section to be taken through the window.

25. Make a plan of a fire-place, faced and lined with pressed brick, showing how the flues should be built and the framing of the floor around same, indicating the distance the beams should be kept from the flue. Figure same.

KNOWLEDGE OF MATERIALS, DRAWING, AND DESIGN.

(Use of slide-rule is permitted in computations).

1. Figure the strains on the members of the truss shown below. Assume wind pressure as 40 pounds per square foot horizontal; snow, roof, and covering as 40 pounds per horizontal square foot. Truss is fixed at A and rests on steel built column 20 feet high; free at B, resting on rollers on brick wall. Distance between trusses is 10 feet. To prevent bending of column a knee brace is to be provided. Distance from foot of column to knee brace is 12 feet. Show all your calculations. (A Fink roof truss 100 foot span and 25 foot rise was given.) **2.** Show, in pencil, details at A and B, and of foundation of column, so that maximum pressure on subsoil may not exceed 1,000 pounds per square foot. Find, also, strain in knee brace and bending moment on column. **3.** (a) Describe briefly the process to which ore is subjected before it is suitable for structural cast-iron work. (b) Name and describe, in detail, one method of making steel. **4.** A floor space, 25 by 40 feet clear, is to be covered with a steel beam and girder floor without columns. The total floor load, including weight of floor, is 400 pounds per square foot. Allowing maximum strain on fibers of 15,000 pounds per square inch, show by a neat pen-and-ink figured sketch the most economical and suitable arrangement. Add written notes when necessary. The moment of inertia of 10-inch I beam 25 pounds per foot is

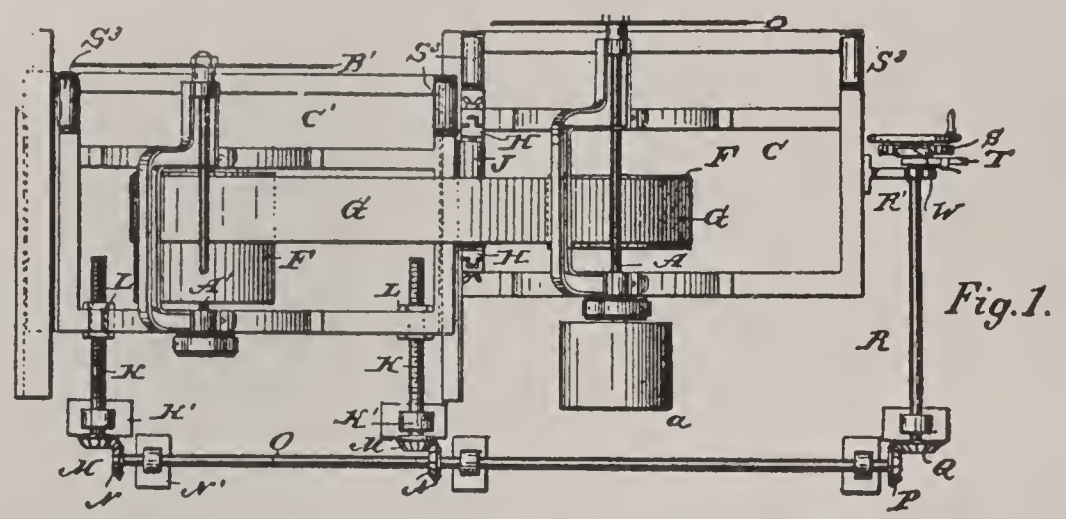


Fig. 1.

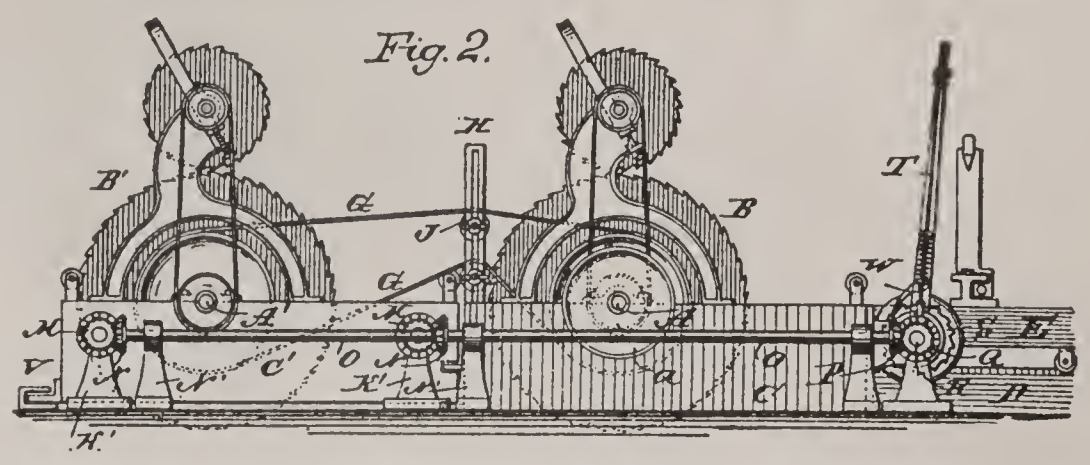


Fig. 2.

equal to 122.5; 10-inch I beam 33 pounds per foot is equal to 161.3; 12-inch I beam 32 pounds per foot is equal to 222.3; 12-inch I beam 40 pounds per foot is equal to 281.3; 15-inch I beam 41 pounds per foot is equal to 424.1; 15-inch I beam 50 pounds per foot is equal to 529.7; 15-inch I beam 60 pounds per foot is equal to 644; 15-inch I beam 80 pounds per foot is equal to 785.

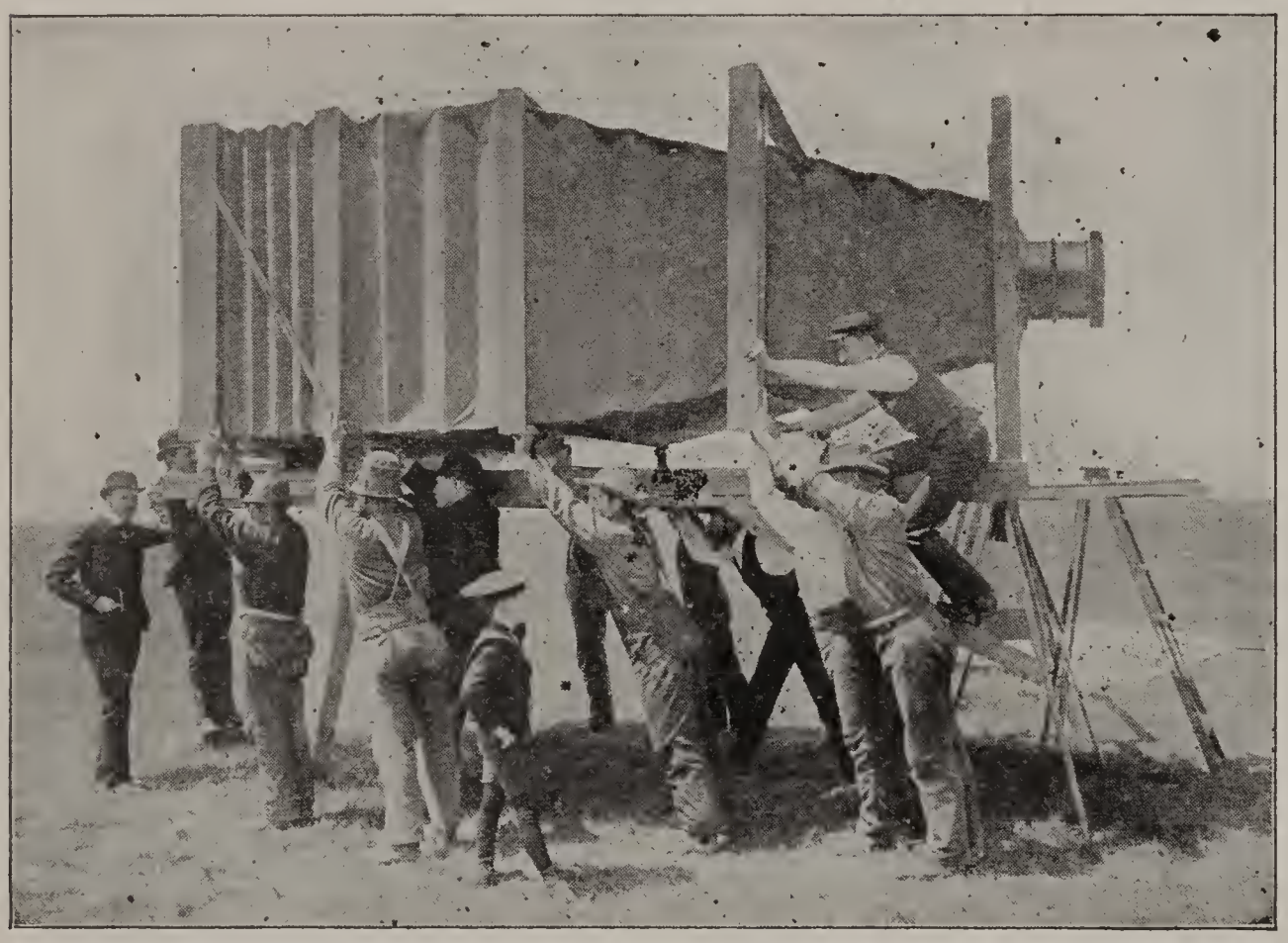
5. A plate girder 27 feet long and 3 feet deep carries a load of 3,000 pounds per foot and a concentrated load of 50,000 pounds at 6 feet from each end. Proportion the girder to sustain this total load, allowing maximum flange strain of 15,000 pounds per square inch, and shear in web and rivets of 8,000 pounds. Show all your calculations. **6.** Make detail drawings, in pencil, of the girder to three-fourths-inch scale. Figure all dimensions and rivet spacing. **7.** A column carries, at first-floor level, four beams. The beams are arranged and transmit to the column the loads, as shown on the sketch below. Length of

column is 13 feet from base to top of beam at first floor and 25 feet from top of beam at first floor to top of beam at second floor. The column rests on a concrete base and is to be built of plates and angles. Design the column and all connections. Assume strain on column as 10,000 pounds per square inch, shearing value seven-eighths-inch rivets as 6,000 pounds, and bearing value of seven-eighths-inch rivets as 15,000 pounds per linear inch of bearing. Allow pressure on concrete base of 8 tons per square foot. Show all your calculations. **8.** Make a drawing, in pencil, of the column, showing all connections and base.

NOTE.—For question 7 the column carries, at first-floor level, four beams at right angles, in pairs, and unequally loaded; at second-floor level three beams, unequally loaded and at 120° to each other, are carried.

BUILDING SUPERVISION.

1. (a) State what mental and moral qualities a successful superintendent must possess. (b) State what technical qualifications he should possess. **2.** (a) How would you check the stakes defining the lot on which the building is to be erected, under your superintendence, and how would you fix them for future reference? (b) What points would you attend to in the excavation for foundation? **3.** (a) The foundation having been excavated to the depth specified, how would you test its bearing capacity? (b) If its capacity did not come up to requirements of specification, what would you do? **4.** If the nature of the soil is such that wooden piles must be used and have been specified, state fully what you would do, as a superintendent, from the time of arrival of the piles on the ground until they are driven in conformity to contract requirements. **5.** State what precautions you would take in order to obtain the best quality of work and best results in foundation footings (a) of concrete, (b) of brick, and (c) of stone. **6.** In the superintendence of cut work, either in granite, sandstone, or limestone, what precautions would you take in order to obtain the specified standard (a) in material, (b) in the cutting and molding, and (c) in the setting of the stone? **7.** If, in your opinion, the contractor is using material not up to specification, or the quality of the work done, through inefficiency of workmen or other cause, is not first class; and, generally, when the work in any respect is not being conducted or performed according to your interpretation of specification and contract, state, in detail, what course or courses you would pursue. **8.** State what general considerations should govern a superintendent's course of action in all matters relating to his work.



Largest photograph camera in the world. This camera was used in making many of the illustrations in this book.

PRACTICAL KNOWLEDGE OF HEATING AND VENTILATION.

1. Name the various means employed for warming buildings and briefly describe the principal systems. **2.** Describe the construction of the usual style of direct radiators used for low pressure steam heating. **3.** State the difference between direct steam radiators and those used for direct hot watr heating. **4.** Where should automatic air valve be located on a direct steam radiator, and also on an indirect steam radiator? **5.** (a) How should flow and return pipes of a low pressure steam heating apparatus be graded? (b) How should similar pipes of a low temperature hot water heating apparatus be graded? (c) How is air expelled from a hot water heating system? **6.** Explain the use of eccentric fittings in the pipe system of a steam heating apparatus. **7.** What is the relative position of outlets of a 6 by 4 by 2 inch eccentric "T" placed in the main flow pipe of (a) a low pressure steam heating apparatus, and (b) a low temperature hot water heating apparatus? **8.** State how globe valves should be placed on horizontal steam flow pipes. **9.** Explain the use an operation of automatic air valves on steam radiators. **10.** To warm and ventilate a building it is necessary to introduce 570,000 cubic feet of fresh air per hour, which amount of air is to be heated from plus 20° to 110° F. by indirect radiation. The indirect radiation to be used will emit 470 heat units per square foot per hour. How many square feet of indirect radiation will be required?

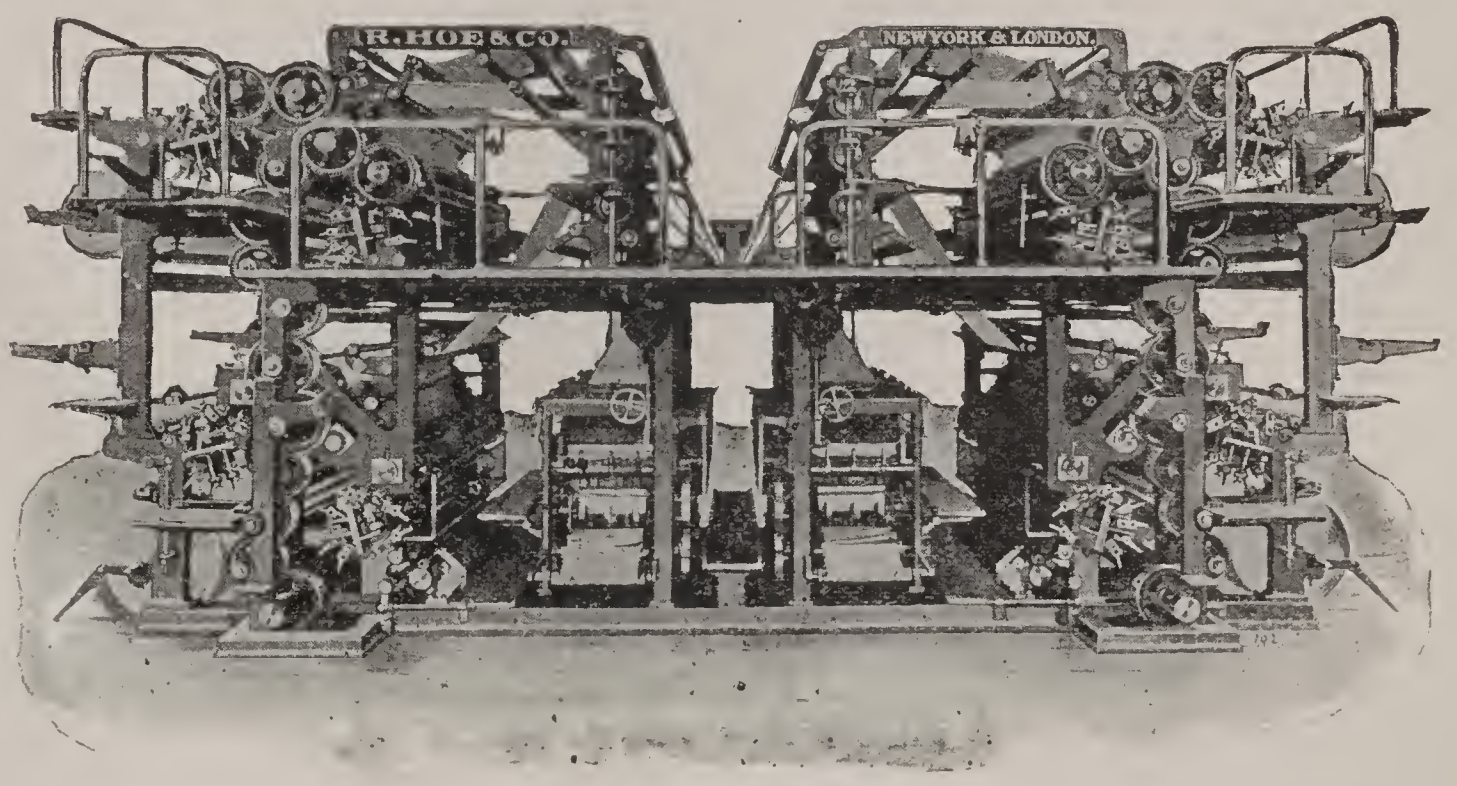
METEOROLOGY.

1. Give the composition of the atmosphere. **2.** Why are barometric observations corrected

for temperature and elevation? **3.** How is the force and velocity of the wind measured? **4.** Give the conditions favorable for the formation of dew and frost. **5.** What is understood by the term "cyclone?" Make a diagram showing direction of surface winds within its area. **6.** Give the causes of rainfall. **7.** What are clouds? Into what principal classes are they divided? **8.** What are the principal steps in the construction of a standard thermometer? **9.** What is a river gauge? Explain its construction. **10.** How is atmospheric pressure measured? Explain the construction of the instrument.

MEAT INSPECTION.

1. What are the symptoms of rabies in bovine animals? With what diseases may rabies be confounded? **2.** How may tuberculosis be detected (a) in the living animal, (b) by examination of the carcass, excluding the viscera? **3.** Describe the appearance in the carcass, excluding the viscera, by which (a) Texas fever, (b) hog cholera, (c) anthrax, may be detected. For what diseases (one for each) may they be mistaken? **4.** Name some of the conditions and also the specific infectious diseases which may cause hæmoglobinuria. How could a specific disease be definitely determined as a cause? **5.** Enumerate the symptoms of parturient fever. State whether the meat of a cow thus affected is fit for food, and the reasons for the answer given.



Latest model printing press.

CHEMISTRY.

1. Describe the metal mercury. State what are some of its important alloys, and give their composition. Give the formulæ of the official salts of mercury. **2.** State the tests to be relied upon for the detection of arsenic. Give a brief description of the methods of procedure in applying these tests. How would you prepare, by an official process, an antidote to arsenical poisoning? **3.** Describe the metal aluminum. How is it prepared, and mention any improved processes lately applied? Give a brief description of the useful alloys into which this metal enters. **4.** Give the chemical formulæ of, and describe, magnesii sulphas and magnesii carbonas. State what are the points of difference between magnesia and magnesia ponderosa. Describe the preparation of magnesii citras effervescens. **5.** What are the various natural sources of the sodium salts? Describe the ammonia soda process for the manufacture of sodium carbonate, stating the uses made of the by-products in the operation, and giving all formulæ. **6.** Contrast the qualitative tests of the ferrous and ferric salts. **7.** Show by structural formulæ the difference between the open and closed chain hydrocarbons. Name the class of compounds derived from each, mentioning, as an example, any one that may be official. **8.** What is an alcohol; an ester; an ether? Name an official substance as an example of each, and give constitutional formulæ. **9.** What are the chemically distinctive features of alkaloids; of glucosides? Name two official drugs as examples of each. **10.** What are the physical and chemical differences between essential oils and fixed oils; between camphors and resins?

PHARMACY.

1. Give the unabbreviated official name and ingredients of collodion, fluid extract of licorice, purified ox gall, Donovan's solution, washed sulphur. **2.** Give the English name and ingredients of acidum hydrocyanicum dilutum aqua chlori, ferri carbonas saccharatus, spirits ammoniæ, massa hydrargyri. **3.** Give the official names of the mineral acids. Which of them are required to "contain 10 per cent of absolute" acid? **4.** What is the official designation of the substance usually known as antifebrin? To what class of compounds does it belong? What are its physical properties; its best solvents; its reactions? **5.** What are the pharmacopœial requirements for opium? Describe the official process for the assay of opium. **6.** Name the ingredients and the quantities necessary to add to 236 gm. of powdered licorice root to make 1,000 gm. of compound licorice powder. Give the method of preparation and the official title. **7.** What drugs enter into the composition of compound tincture of benzoin? Give the botanical name, natural order, habitat, and portion used of the plant from which each is derived? **8.** Give the official name, chemical formula, uses, and dose of each of the following substances, and state the official preparation into which each of them enters: Silver nitrate, rochelle salt, mercuric iodide, subnitrate of bismuth, and tannin.

9. Give full pharmacopœial directions for the manufacture of suppositories. What differences are prescribed for rectal, urethral, and vaginal suppositories? **10a.** Criticise the two following prescriptions:

R

Quin. Sulph.	gr.	xxxii
Tr. Ferri Chlor.		
Sp. Ammon. Aromat.	aa.	iv
Aquæ Font.	q. s. ad.	iii

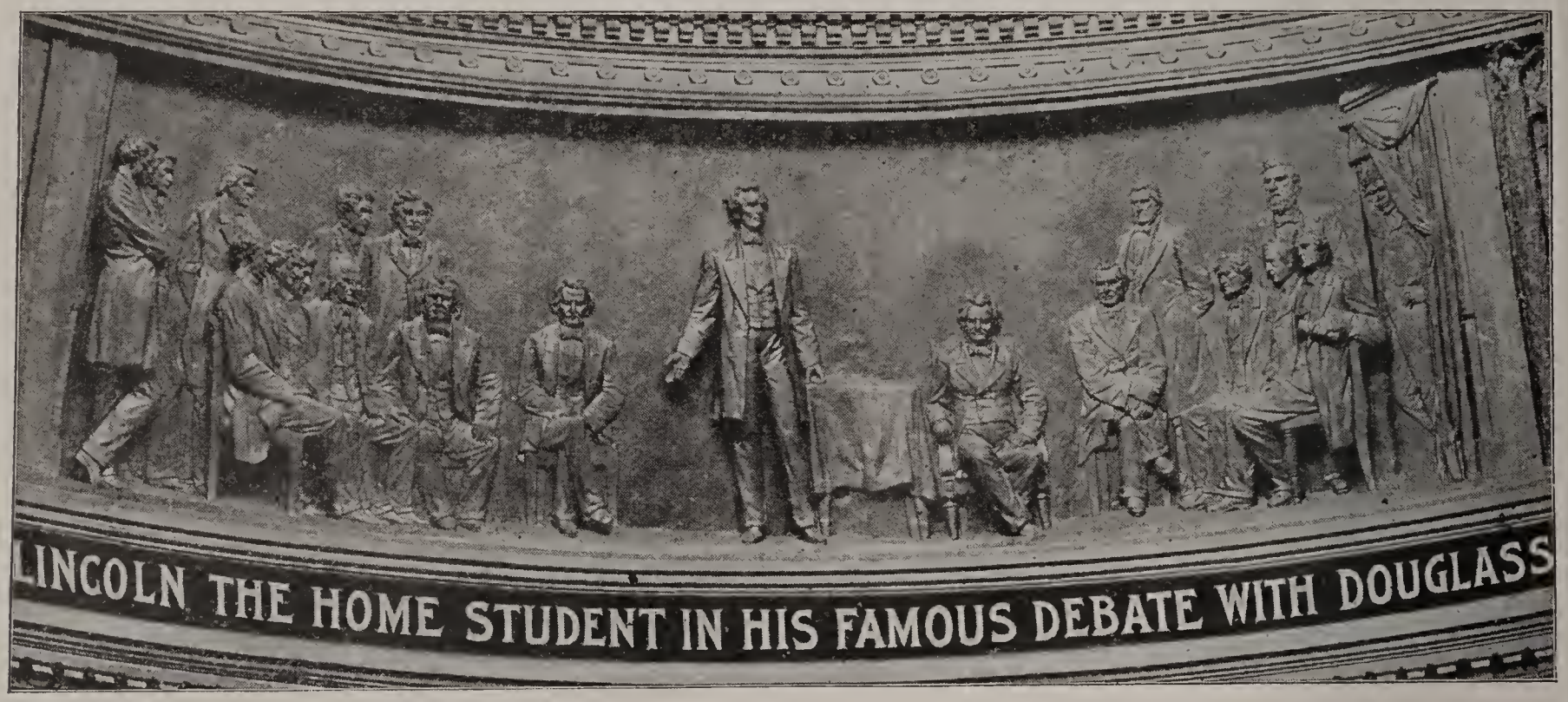
Sig.: A teaspoonful 3 times daily.

R

Morphia Sulph.	gr.	iii
Potassa Brom.		ii
Aqua Cinnam.	q. s. ad.	iii

MATERIA MEDICA.

1. Jalap: Give the botanical name, natural order, and habitat of the plant. Describe the drug. What per cent of resin should it contain? State the behavior of this resin to simple solvents and to chemical solvents. How is it distinguished from the resins of false jalaps? Give the dose of jalap and of the resin. **2.** Flaxseed: Name the plant and its natural order. Describe the drug, and explain its structural characteristics. Name its important medicinal constituents, and state the location of each in its tissues. **3.** What is lupulin? Name the plant, and the part of the plant yielding it. Name its important constituents, and explain the change taking place on exposure. Give the medicinal properties of lupulin and its dose. **4.** Name the plants belonging to the natural order Papaveraceæ which yield official drugs. Give the part used, the most important constituent, the therapeutic uses of each constituent named, and the dose of each drug. **5.** Give the botanical origin, natural order, part of plant used, active principle, medicinal properties, and dose of each of the following-named drugs: Capsicum, aspidium, coca, ergota, colchicum. **6.** To what class of drugs does cantharis belong? What is its habitat? How is it collected? Describe the drug, naming its active principle. State the method for the valuation of cantharis and the amount of active principle which it should yield. What is its medicinal use and dose? **7.** What is musk? Give the species, order, and habitat of the animal from which obtained. Describe the drug, and name the varieties to be met with. What are its constituents, its uses, and dose? **8.** State the botanical origin, natural order, and habitat, and give a brief description of each of the following-named gum-resins: Ammoniac, myrrh, gamboge, assafœtida, scammony. **9.** From what part of the plant is ginger derived? What is the botanical origin and habitat of the plant? Give a brief description of the drug. What varieties are met with? To what is the hot taste of ginger due, and to what its aromatic odor? What are its medicinal uses? **10.** What is the botanical origin of cane sugar? Describe its preparation. Give a brief description of physical and chemical properties, including its molecular composition. What is used to whiten imperfectly decolorized sugars, and how may this substance be detected?



INSANITY.

I.—QUESTIONS ON MEDICAL TREATMENT OF THE INSANE.

1. What influence has gastro-intestinal intoxication on insanity? Give the treatment for its relief.

2. Describe in detail your treatment of a case of melancholia complicating the last three months of pregnancy.

3. Describe the conditions which would counter-indicate the use of forced feeding with the esophagal tube.

4. Give the prophylaxis and treatment of a bed sore in a case of general paralysis.

5. Give your opinion of the value and uses of hydrotherapy in the treatment of the insane.

II.—QUESTIONS ON HOSPITAL LAW, ADMINISTRATION AND DISCIPLINE.

1. Sketch the qualifications that you conceive to be ideal for a first assistant physician.

2. Give concisely the argument for non-restraint in the care of the insane.

3. Defend, if you can, the proposition that the

way out of a hospital for the insane is often through the workshop, and state how you would conduct, on a large scale, a scheme of employment containing a thousand or more patients.

4. Describe a method of dining-room service which in your judgment would be likely to secure the best results as regards the feeding of patients.

5. Describe some methods of sewage purification.

6. What means would you adopt to correct untidy habits in a patient whose untidiness is the result of indolence?

7. What warrant is there in law for refusal by a superintendent of a state hospital to admit a patient who had been adjudged insane and ordered committed thereto by a judge of a court of record?

8. What is necessary to secure the discharge from custody of a patient committed to a state hospital upon order of a court having criminal jurisdiction, in an action arising from a criminal offense?

9. State the qualifications prescribed by the statute for the office of president of the Lunacy Commission.

10. What persons are liable for the care and support of the insane other than the poor and indigent?

LAW.

1. (a) When one statute is repealed by another, of what effect is the repeal of the repealing statute? (b) State three leading principles governing construction of statutes. **2.** (a) What power is granted by the Constitution as to creation of United States inferior courts? To whom is it granted? (b) How far has the power called for in (a) been exercised, and which was the last instance of its exercise? **3.** (a) If part of a law is unconstitutional, how are other parts affected? (b) Under judicial construction placed upon *habeas corpus* clause of the Constitution, in whom only is right to suspend writ? **4.** (a) State essential distinction between common law and equity. (b) Name eight enumerated powers of Congress. **5.** (a) Show by examples the distinction between *competency* of evidence and *sufficiency* of evidence, and state by whom each is determined. (b) What is the rule as to hearsay evidence? Name two reasons for the rule. **6.** (a) Explain the doctrine of *res gestæ*. Illustrate. (b) Name four classes of matters of which the courts take judicial notice. **7.** (a) What is the general rule as to a party's impeaching his own witness? Give the reason for the rule. (b) State whether or not in general a witness may be questioned as to collateral facts, and give the general rule as to the production of testimony which govern in such a case. **8.** (a) State briefly the conditions which gave rise to courts of equity. (b) A testator died, never having had but three sons, John, William, and James. He left his entire estate to his sons, naming them in his will as John, William, and Frederick. How should the will be construed? What is the rule of law as to a patent ambiguity? What as to a latent ambiguity? **9.** (a) A agrees to sell B certain goods and passes the title to them. The goods can not be duplicated and are of peculiar value to B. A refuses to deliver the goods. What remedy, if any, has B at law? What at equity? Name one ground of equitable jurisdiction. (b) When, if ever, will courts of equity entertain the question of inadequacy of consideration? **10.** (a) In what respect does a mortgage differ from a deed, and what is meant by an equity of redemption? (b) What underlying principle requires that a deed be recorded? Name an instance in which a duly executed and recorded deed would be void, although the title of record was in the grantor at the time of the delivery of the deed. **11.** (a) What is the paramount principle observed by courts in construing a will, and what portion of a will is construed under the law, and what portion under equity? (b) How, and by whom, is the estate of a person administered who dies intestate? What is meant by widow's right of dower.



The telegraph operators in the office of the War Department, Washington.

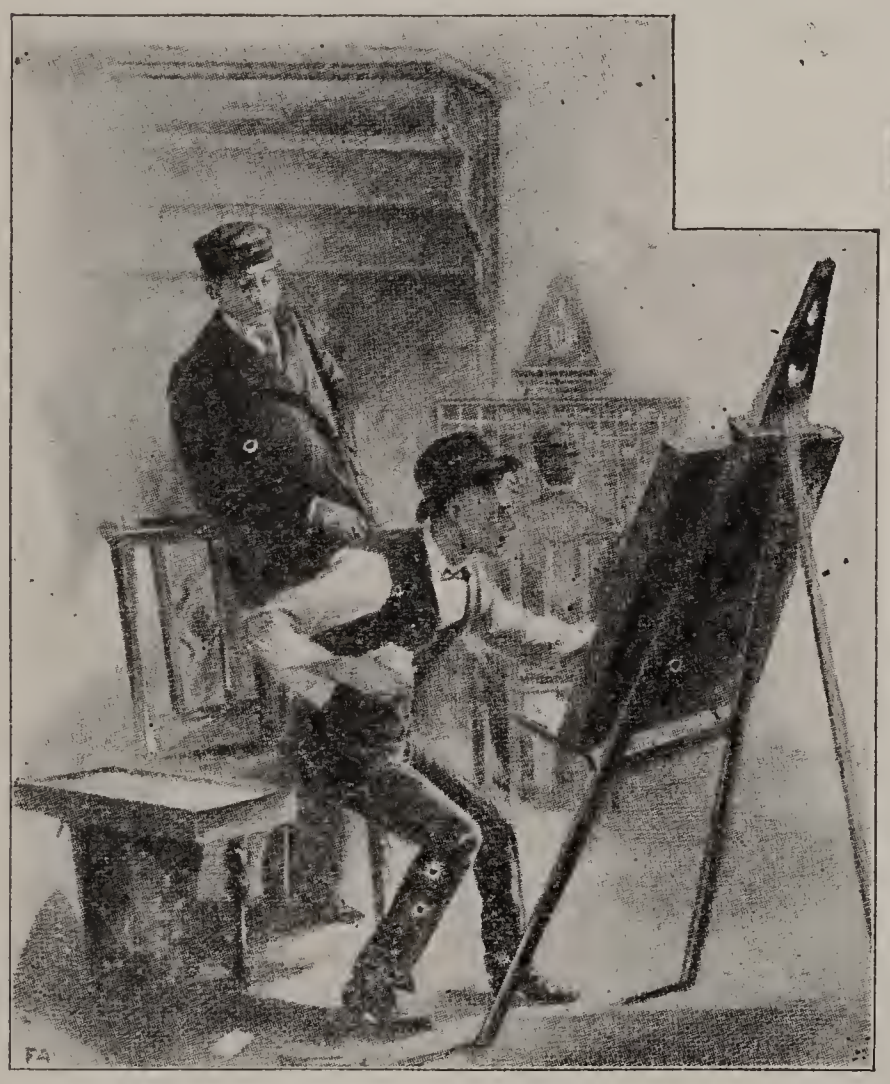
PUBLIC LAND LAW.

1. Where are plats of public surveys kept for public information? **2.** How are entries of public agricultural land made of record in the local

land office? **3.** How soon after the filing of a township plat in the local land office may final proof be accepted for land embraced therein? **4.** What notice is given of the filing of plat of survey in the local office, and by whom is such notice given?

PUBLIC LAND SURVEYING.

1. Illustrate by diagram and explain briefly the manner and order of running the exterior lines of a block of townships 24 miles square, whose south boundary, when run, will be the first



The examination of an applicant for Post Office service. A test in mail distributing.

standard parallel north, and whose west boundary will be the first guide meridian west of the sixth principal meridian, which principal meridian has already been established. **2.** Describe in the order of importance the different accessories allowed and the markings thereon in the survey of public lands on a corner stone located at the corner of sections 22, 23, 26, and 27, T. 31 S., R. 4 W., sixth principal meridian. Give field notes descriptive of all allowable accessories to such corner stone. **3.** (a) What bodies of water in or bordering on the public domain are required to be meandered? (b) Describe the method of running meander lines. **4.** The east boundary of section 6 in a township is 79.76 chains; the west boundary, 80 chains; the north boundary, 80.42 chains, and the south boundary, 80.10 chains; calculate the areas of each of the seven fractional lots in a regular subdivison of this section.

PENSION LAW.

1. Define each of the following terms as used in the pension laws: (a) Invalid pension, (b) reimbursement, (c) increase (invalid), (d) "minor child." **2.** (a) State all the conditions on which a volunteer soldier of the war of 1861-1865 may be entitled to a pension. (b) On what conditions may a soldier of the Regular Army disabled in 1869 be pensioned? **3.** To what rate of pension is each of the following-named entitled, the soldier or sailor having died from causes due to service in the war of 1861-1865: The widow of a captain in the Navy; the mother of a major in the Army; the dependent brother of a second lieutenant in the Army; the minor child of a private soldier. **4.** (a) For service in what wars are "service pensions" allowed? (b) Who may receive "service pensions?" (c) State the monthly rate of pension now paid to each of the persons required to be named in (b), and if the rate has in any case been changed, give the former rate in each such case. **5.** (a) What provision is made in the pension laws with reference to the proof of marriage in ordinary cases? (b) In what cases does date of marriage to soldier of widow applicants for pension affect their title thereto, and in what case will it determine the rate of pension to be paid? **6.** (a) Define the term "permanent specific disability." (b) Name three permanent specific disabilities, the monthly rate for each of which is $30. (c) What is the highest monthly rate of pension paid for disability, and for what disability is it allowed? **7.** (a) What is a fee agreement and what must it contain? (b) What are the provisions of the pension laws relative to the amount of attorney fees allowed for successful prosecution of a claim for pension: (1) By "special act;" (2) for an army nurse; (3) for disability of service origin; (4) for disability not due to service? (c) Who pays these fees and from what fund? **8.** (a) What facts or circumstances will operate to terminate pension in each of the following cases, the pension having been properly granted originally: (1) That of a soldier pensioned under the act of June 27, 1890; (2) that of a dependent mother; (3) that of a minor brother? (b) State all the circumstances under which an invalid pension may commence on the day after the applicant's discharge from service in the war of 1861-1865. **9.** (a) State all the facts which must be shown to entitle the mother of a soldier to pension.

PEARLS AND PEARL HUNTING IN THE UNITED STATES.

How Pearls Grow, and the Great Value of Some Finds by Amateurs

Wherever the oyster, mussel or other shell fish is to be found in river, lake or sea, there is a laboratory for the making of pearls.

Just how they are made no one yet knows, and there is no theory as to how the nacre is secreted that gives their wonderful powers of iridescence. Of all the theories of their formation the most acceptable is that particles of foreign matter, floating in between the shells, causes irritation and leads the mussel to coat the tiny bits of alien substances with successive layers of nacre, thus forming the pearls. This theory seems plausible and is held by many to be correct.

But it is not scientifically true, for when a pearl is dissected, it is found to be built just as an onion is, one layer of nacre overlapping the inner, and the very heart of the gem is of its own precious substance. Sometimes a tiny speck appears in the center, which may, or may not have been, originally, a grain of sand.

Nevertheless, it is a known fact to the Orientals, that tiny objects slipped in between the shells of living bivalves will after a certain length of time be brilliantly covered with nacre, and, profiting by this knowledge they have slipped minute tin images of Buddha into the shells, and, at the proper time, when they displayed the result, announced to the credulous natives that these were "miraculous images," which, consequently, they sold for enormous sums.

It is not generally known that the little village of Smithville in Tennessee is the second largest pearl market in the United States. Its yearly trade in pearls is nearly a quarter of a million dollars.

Pearls were not known to exist in the United States till about 1850, and as an active industry, the hunting of pearls did not amount to but little until the last decade.

Pearls of perfect form and beauty, exquisite color and great value have been found in the rivers and streams in various parts of the state, and the great Tiffany himself is authority for the statement that the finest pink pearls in the world are found in the mountain streams of Tennessee.

Numbers of men, women and children line the banks of the rivers and mountain streams in all parts of Tennessee, and, having procured baskets of mussels from their beds and shoals, spend day after day opening the shells with their rough knives and seek to tear from the mussel's heart its precious treasure.

But the natives are not left in undisturbed monopoly of their eager search for wealth, for very often parties of ladies and gentlemen of the highest social standing in the state, for weeks at a time each summer, become dwellers in tents, and seek their pleasure in pearling, either in boats on the river or on the river banks beneath gay awnings.

Success, however, is variable. Not that the gems themselves are scarce, for it is a poor mussel, indeed, that does not possess its own private laboratory for pearl-making, but the pearls themselves must be

a trinity of perfection—perfection in form, color and in orient—to be valuable and, of course, a threefold perfection is rare.

A pearl is restricted to narrow limits when it is a question of form; it must be a perfect sphere or a perfect pear-shape to meet its first requisite of value. All baroques, or pearls of grotesque shape, however bright their luster or perfect their color, are without value and, until recently, have usually been cast back into the water; but of late, fashion has found use for these odd-shaped pearls, in pendants, and unique rings, and very beautiful results are obtained. This is considered a mere caprice of fashion, however, and unlikely to give permanent value to the baroque.

In the choice of color, the pearl hunter enjoys greater latitude, for if the gem is perfect in form and orient, it may be either white, rose, yellow or black, and be of equal value, while some very rare and beautiful pearls have been a rich bronze, dark green and metallic blue, but of exceedingly beautiful luster.

Generally speaking, pearl-bearing mussels are found in all limestone water, and the chemical analysis of pearls shows them to be 90 per cent lime, 6 per cent organic matter, and 4 per cent water; but in the waters of Michigan and Wisconsin very beautiful pearls of rich bronze and brilliant peacock colors have been found, which tend to show that the organic matter in their composition was strongly impregnated with the copper of those regions.

The pearl-bearing mussels are of three varieties—Rough Mussel, known by its roughly corrugated shell; the Horse Mussel and the Black Horse Mussel, and each of these is found scattered through the rivers, streams and creeks of Tennessee. They usually live half-buried in the mud at the river bed, or are seen in great shoals, in the shallow pools, and very often are found crawling about in the reeds and grasses at the water's edge, where they can be tracked by their narrow zigzag line in the sand.

The patience required in pearl hunting and the nature of the work not being agreeable to many, makes it perhaps an industry less followed than many others of even less results.

Since there is hardly a river anywhere in the United States that does not have some kind of a shell fish, there is a strong probability that patient labor on the part of some one sufficiently interested, would develop the fact that there are mines of pearls hitherto undiscovered that would make many a youthful wader in the waters, both rich and happy.

It is not generally known, but it is, nevertheless, true that a really fine pearl of perfect orient makes even the brightest diamond dull if compared, and if examined in the sunlight such a pearl emits such dazzling flashes of light as are almost blinding to the unprotected eye.

POPULATION

OF

CITIES, TOWNS AND VILLAGES

Having 5000 or more Inhabitants in 1900, Compared with the Enumeration of 1890

	1900.	1890.
ALABAMA.		
Anniston	9,695	9,998
Bessemer	6,358	4,544
Birmingham	38,415	26,178
Florence	6,478	6,012
Huntsville	8,068	7,995
Mobile	38,469	31,076
Montgomery	30,346	21,883
Selma	8,713	7,622
Tuscaloosa	5,094	4,215
ALASKA.		
Nome City	12,486	.....
ARIZONA.		
Phœnix	5,544	3,152
Tucson	7,531	5,150
ARKANSAS.		
Fort Smith	11,587	11,311
Helena	5,550	5,189
Hot Springs	9,973	8,086
Little Rock	38,307	25,874
Pine Bluffs	11,496	9,952
CALIFORNIA.		
Alameda	16,464	11,165
Berkeley	13,214	5,101
Etna	7,327	4,858
Fresno	12,470	10,818
Los Angeles	102,479	50,395
Oakland	66,960	48,682
Pasadena	9,117	4,882
Pomona	5,526	3,634
Riverside	7,973	4,683
Sacramento	29,282	26,386
San Bernardino	6,150	4,012
San Diego	17,700	16,159
San Francisco	342,782	298,997
San Jose	21,500	18,060
Santa Barbara	6,587	5,864
Santa Cruz	5,659	5,596
Santa Rosa	6,673	5,220
Stockton	17,506	14,424
Vallejo	7,965	6,343
Boulder	6,150	3,330
COLORADO.		
Colorado Spr'gs.	21,085	11,140
Cripple Creek	10,147	.....
Denver	133,859	106,713
Pueblo	28,157	24,558
Trinidad	5,345	5,523
CONNECTICUT.		
Ansonia	12,681	10,342
Branford	5,706	4,460
Bridgeport	70,996	48,886
Bristol	6,286	(*)
Danbury	16,537	16,552
Derby	7,930	5,969
East Hartford	6,406	4,455
Greenwich	12,172	10,131
Groton	5,962	5,539
Hartford	79,850	53,230
Killingly	6,835	7,027
Manchester	10,601	8,222
Meriden	24,296	21,652
Middletown	9,589	9,013
Naugatuck	10,541	6,218
New Britain	25,998	16,519
New Haven	108,027	81,298
New London	17,548	13,757
Norwalk	6,125	(*)
Orange	6,995	4,537
Putnam	6,667	(*)
Rockville	7,287	7,772
Southington	5,890	5,501
South Norwalk	6,591	(*)
Stamford	15,997	15,700
Stonington	8,540	7,184
Torrington	8,360	4,283
Wallingford	9,001	6,584
Waterbury	45,859	28,646
West Haven	5,247	2,697
Willimantic	8,937	8,648
Winsted	6,804	4,846

(*) Not separately reported.

	1900.	1890.
DELAWARE.		
Wilmington	76,508	61,431
FLORIDA.		
Jacksonville	28,429	17,201
Key West	17,114	18,080
Pensacola	17,747	11,750
Tampa	15,839	5,532
GEORGIA.		
Americus	7,674	6,398
Athens	10,245	8,639
Atlanta	89,872	65,533
Augusta	39,441	33,300
Brunswick	9,081	8,459
Columbus	17,614	17,303
Griffin	6,857	4,503
Macon	23,272	22,746
Rome	7,291	6,957
Savannah	54,244	43,189
Thomasville	5,322	5,514
Valdosta	5,613	2,854
Waycross	5,919	3,364
HAWAII.		
Honolulu	39,306	22,907
IDAHO.		
Boise	5,957	2,311
ILLINOIS.		
Alton	14,210	10,294
Aurora	24,147	19,688
Belleville	17,484	15,361
Belvidere	6,937	3,867
Bloomington	23,286	20,484
Blue Island	6,114	3,329
Cairo	12,566	10,324
Canton	6,564	5,604
Centralia	6,721	4,763
Champaign	9,098	5,839
Charleston	5,488	4,135
Chicago	1698575	1099850
Chicago Heights	5,100	.....
Danville	16,354	11,491
Decatur	20,754	16,841
DeKalb	5,904	2,579

	1900.	1890.
Dixon	7,917	5,161
East St. Louis	29,655	15,169
Elgin	22,433	17,823
Evanston	19,259	.....
Freeport	13,258	10,189
Galena	5,005	5,635
Galesburg	18,607	15,265
Harvey	5,395	.....
Jacksonville	15,078	12,935
Joliet	29,353	23,264
Kankakee	13,595	9,025
Kewanee	8,382	4,569
LaSalle	10,446	9,855
Lincoln	8,962	6,725
Litchfield	5,918	5,811
Macomb	5,375	4,052
Mattoon	9,622	6,833
Moline	17,248	12,000
Monmouth	7,460	5,930
Mount Vernon	5,216	3,23
Murphysboro	6,463	3,880
Ottawa	10,588	9,985
Pana	5,530	5,077
Paris	6,105	4,990
Pekin	8,420	6,347
Peoria	56,100	41,024
Peru	6,863	5,520
Quincy	36,252	31.49
Rockford	31,051	23,584
Rock Island	19,493	13,634
Springfield	34.159	24,96
Spring Valley	6,214	3,837
Sterling	6,309	5,824
Streator	14,079	11,414
Urbana	5,728	3,511
Waukegan	9,426	4,915
INDIANA.		
Alexandria	7,221	715
Anderson	20,178	10,741
Bedford	6.115	3.351
Bloomington	6,460	4,018
Brazil	7,786	5,905
Columbus	8,130	6,719
Crawfordsville	6,649	6,087
Elkhart	15,184	11,360
Elwood	12,950	2,28
Evansville	59,007	50,756
Fort Wayne	45,115	35,39
Frankfort	7,100	5,919
Goshen	7 810	6,033
Greensburg	5,034	3,59
Hammond	12.376	5,428
Hartford	5,912	2,28
Huntington	9.491	7,32
Indianapolis	169,164	105,43
Jeffersonville	10.774	10 6
Kokomo	10,609	8.261
Lafayette	18,116	16,243
Laporte	7,113	7,12
Logansport	16.204	13.32
Madison	7,835	8.93
Marion	17.337	8,769
Michigan City	14.850	10.77
Mishawaka	5.560	3.371
Mount Vernon	5.132	4.705
Muncie	20.942	11 345
New Albany	20,628	21-05
Peru	8,463	7,02
Princeton	6,041	3.07
Richmond	18,226	16,60
Seymour	6.445	5.3
Shelbyville	7.169	5.45
South Bend	35.999	21,819
Terre Haute	36,673	30,217
Valparaiso	6,280	5,090
Vincennes	10.249	8.853
Wabash	8,618	5,105
Washington	8,551	6,064
INDIAN TERRITORY.		
Ardmore	5,681	.....
IOWA.		
Atlantic City	5,046	4.351
Boone	8,880	6,520
Burlington	23,201	22,565
Cedar Falls	5,319	3,459
Cedar Rapids	25,656	18,020
Centerville	5,256	3,668
Clinton	22,698	13,619
Council Bluffs	25,802	21,474
Creston	7,752	7,200
Davenport	35,254	26,872
Des Moines	62,139	50,093
Dubuque	36,297	30,311
Fort Dodge	12.162	4,8 1
Fort Madison	9,278	7,901
Iowa City	7,987	7,016
Keokuk	14,641	14,101
Marshalltown	11,544	8,914
Mason City	6,746	4,007
Muscatine	14,073	11,454
Oelwein	5,142	830
Oskaloosa	9,212	6,558
Ottumwa	18,197	14,001
Sioux City	33,111	37,80
Waterloo	12,580	6,674
KANSAS.		
Argentine	5,878	4,732
Argonia	6,140	8,347
Atchison	15,722	13,963
Emporia	8,223	7,551
Fort Scott	10,322	11,946
Galena	10,155	2,496
Hutchinson	9,379	8,682
Iola	5,791	1,706
Kansas City	51,418	38.316
Lawrence	10,862	9,997
Leavenworth	20,735	19,768
Newton	6,208	5,605
Ottawa	6,934	6,248
Parsons	7,682	6,736
Pittsburg	10,112	6,697
Topeka	33.608	31,007
Wichita	24 671	23,853
Winfield	5,554	5,184
KENTUCKY.		
Ashland	6,800	4,195
Bellevue	6,332	3,163
Bowling Green	8,226	7,803
Covington	42,938	37.371
Dayton	6,104	4,264
Frankfort	9,487	7,89
Henderson	10.272	8,835
Hopkinsville	7,280	5,833
Louisville	204,731	161,129
Maysville	6,423	5,358
Newport	28,301	24.91
Owensboro	13.189	9.837
Paducah	19.446	12.79
Winchester	5.964	4,519
LOUISIANA.		
Alexandria	5,648	2,861
Baton Rouge	11.269	10.478
Lake Charles	6.680	3.442
Monroe	5.428	3.256
New Iberia	6,815	3 44
New Orleans	287,104	242,04
MAINE.		
Auburn	12.951	11.250
Augusta	11.683	10,527
Bangor	21 850	19.103
Bath	10.477	8,723
Biddeford	16.145	14.44
Brunswick	6,806	6.019
Calais	7.655	7.290
Gardiner	5,501	5.401
Lewiston	23,761	21.701
Oldtown	5,763	5,312
Portland	50.145	36,495
Rockland	8.150	8,174
Saco	6.122	6.07
South Portland	6.287	.....
Waterville	9.477	7,107
Westbrook	7.283	6,63
MARYLAND.		
Annapolis	8,402	7,604
Baltimore	508,957	434,439
Cambridge	5,747	4,192
Cumberland	17,128	12,729
Frederick	9,296	8,193
Frostburg	5,274	3,804
Hagerstown	13,591	10,11
MASSACHUSETTS.		
Adams	11,134	9,213
Amesbury	9,473	9,798
Amherst	5,028	4,512
Andover	6,813	6,142
Arlington	8,603	5,629
Athol	7,061	6,319
Attleboro	11,335	7,577
Beverly	13,884	10,821
Blackstone	5,721	6,138
Boston	560,892	448,477
Braintree	5,981	4,848
Brockton	40,063	27,294
Brookline	19,935	12,103
Cambridge	91,886	70,028
Chelsea	34,072	27,909
Chicopee	19,167	14,050
Clinton	13,667	10,424
Concord	5,652	4,427
Dana	13,667	10,424
Danvers	8,542	7.454
Dedham	7,457	7,123
Easthampton	5,603	4,395
Everett	24,336	11,068
Fall River	104,863	74,398
Fitchburg	31,531	22,037
Framingham	11,302	9,239
Franklin	5,017	4,831
Gardner	10,813	8,424
Gloucester	26,121	24,651
Gr't Barrington	5,854	4,612
Greenfield	7,927	5,252
Haverhill	37,175	27,412
Holyoke	45.712	35,637
Hyde Park	13,244	10,193
Lawrence	62.559	44,654
Leomister	12,392	7,269
Lowell	94.969	77,696
Lynn	68,513	55,727
Malden	33,664	23,031
Marlboro	13,609	13,805
Medford	18,244	11,079
Melrose	12,962	8,519
Milford	11,376	8,780
Milton	6,578	4.278
Montague	6,150	6,296
Natick	9,488	9,118
New Bedford	62,442	40.733
Newburyport	14,478	13.947
Newton	33,587	24,397
North Adams	24,200	16,074
Northampton	18.643	14 990
North Attleboro	7.253	6,727
Northbridge	7,036	4,603
Norwood	5,480	3.733
Orange	5.520	4.568
Palmer	7,801	6;520
Peabody	11.523	10.158
Pittsfield	21.766	17,281
Plymouth	9.592	7,314
Quincy	23.899	16.723
Revere	10.395	5.668
Rockland	5,327	5,213
Salem	35 9	30.01
Saugus	5,084	3 673
Somerville	61.613	40,152
Springfield	62.05	44 179
Stoneham	6 197	6 155
Taunton	31.036	25.448
Waltham	23.481	18,707
Watertown	9,706	7,073
Webster	8,804	7,031
Westfield	12.310	9,805
West Springfield	7.105	5.077
Winchendon	5,001	4,390
Whitman	6.155	4.441
Winchester	7,248	4.861

	1900.	1890.
Woburn	14,254	13,499
Worcester	118,421	84,655
MICHIGAN.		
Adrian	9,654	8,756
Alpena	11,802	11,283
Ann Arbor	14,509	9,431
Battle Creek	18,563	13,197
Bay City	27,628	27,839
Benton Harbor	6,562	3,692
Cadillac	5,997	4,461
Cheboygan	6,489	6,23.
Coldwater	6,216	5,247
Detroit	285,704	205,876
Escanaba	9,549	6,808
Flint	13,103	9,803
Grand Rapids	87,565	60,278
Holland	7,790	3,945
Ionia	5,209	4,482
Iron Mountain	9,242	8,599
Ironwood	9,705	7,744
Ishpeming	13,255	11,197
Jackson	25,180	20,798
Kalamazoo	24,404	17,853
Lansing	16,485	13,102
Ludington	7,166	7,517
Manistee	14,260	12,812
Marquette	10 058	9,093
Menominee	12,818	10,630
Monroe	5,043	5,258
Mount Clemens	6,576	4,748
Muskegon	20,818	22,702
Negaunee	6,935	6.078
Owosso	8,696	6,564
Petoskey	5,285	2,872
Pontiac	9,769	6,200
Port Huron	19,158	13.543
Saginaw	42,345	46,322
St. Joseph	5,155	3,733
Sault Ste. Marie	10,538	5,760
Traverse	9,407	4,833
West Bay City	13,119	12,981
Wyandotte	5.183	3,817
Ypsilanti	7,378	6,129
MINNESOTA.		
Austin	5,474	3,901
Brainerd	7,524	5,703
Crookston	5,359	3,457
Duluth	52,969	33.115
Faribault	7.868	6,520
Fergus Falls	6,072	3,772
Little Falls	5,774	2.354
Mankato	10,599	8,838
Minneapolis	202,718	164,738
New Ulm	5,403	3,741
Owatonna	5,561	3,849
Red Wing	7,525	6,291
Rochester	6,843	5,321
St. Paul	163,065	133.156
Stillwater	12,318	11,260
Winona	19,714	18,208
MISSISSIPPI.		
Biloxi	5,467	3,234
Columbus	6,484	4,559
Greenville	7,624	6,658
Jackson	7.816	5,920
Meridian	14,050	10,624
Natchez	12,210	10,101
Vicksburg	14,834	13.373
MISSOURI.		
Aurora	6,191	3.482
Brookfield	5,484	4.547
Carthage	9,416	7,981
Chillicothe	6,905	5,717
Clinton	5,061	4.737
Columbia	5,651	4,000
De Soto	5.611	3,960
Hannibal	12,780	12,857
Independence	6.974	6,380
Joplin	26,023	9.943
Kansas City	163,752	132,716
Kirksville	5,966	3.510
Louisiana	5,131	5.090
Marshall	5,086	4,789
Mexico	5,099	4,297
Moberly	8,012	8,251
Nevada	7,461	7,262
St. Joseph	102,979	52,324
St. Louis	575,238	451,770
Sedalia	15,231	14,086
Springfield	23,267	21,850
Trenton	5,396	5,039
Webb	9,201	5,043
MONTANA.		
Anaconda	9 453	3,975
Butte	30,740	10,723
Great Falls	14,930	3,979
Helena	10,770	13,834
NEBRASKA.		
Beatrice	7,875	13,836
Fremont	7,241	6.747
Grand Island	7,554	7,536
Hastings	7,188	13,584
Kearney	5,634	8,074
Lincoln	40,169	55,154
Nebraska City	7.380	11,94
Omaha	102,555	140,452
South Omaha	26,001	8,062
NEW JERSEY.		
Atlantic City	27,838	13,055
Bayonne	32,722	19,033
Bloomfield	9,668	7,708
Bridgeton	13.912	11,424
Burlington	7,392	7,264
Camden	75,935	58,313
Dover	5,938	
East Orange	21,506	13,282
Elizabeth	52,130	37,764
Englewood	6,252	
Gloucester	6,840	6,564
Hackensack	9,443	6,004
Harrison	10,596	8,338
Hoboken	59,364	43,648
Irvington	5,255	
Jersey City	206,433	163,003
Kearney	10,896	
Long Branch	8.872	7.231
Millville	10,583	10,002
Montclair	13,962	8,656
Morristown	11,267	8,156
Newark	246,070	181.830
New Brunswick	20,006	18,603
North Plainfield	5,009	
Orange	24,141	18,844
Passaic	27,777	13.028
Paterson	105,171	78,347
Perth Amboy	17,699	9,512
Phillipsburg	10,052	8,644
Plainfield	15,369	11,267
Rahway	7,935	7,105
Red Bank	5.428	4,145
Salem	5,811	5,516
South Amboy	6,349	4,330
Summit	5,302	3,502
Trenton	73.307	57,458
Union	15.187	10,643
West Hoboken	23,094	11,665
West New York	5,257	
West Orange	6,889	4,358
NEW MEXICO.		
Albuquerque	6,238	3,785
Santa Fe	5,603	6,185
NEW YORK.		
Albany	94,151	94,923
Amsterdam	20,929	17,336
Auburn	30,345	25,858
Batavia	9,180	7,221
Binghamton	39,647	35,005
Canandalgua	6,151	5.868
Catskill	5,484	4,926
Cohoes	23.910	22,509
Corning	11.0..	8.550
Cortland	9,014	8.590
Dunkirk	11,616	9,416
Elmira	35,872	30.893
Fulton	5,281	4,214
Geneva	10,433	7,557
Glens Falls	12,613	9,509
Gloversville	18,349	13,864
Haverstraw	6,935	5,070
Herkimer	5,555	
Hoosick Falls	6,671	7,014
Hornellsville	11,918	10,996
Hudson	9,528	9,970
Ilion	5,138	4,057
Ithaca	13,136	11,097
Jamestown	22,892	16,038
Johnstown	10,130	7,768
Kingston	24,535	21,261
Lansingburg	12,595	10,550
Little Falls	10,381	8,783
Lockport	16,581	16,038
Malone	5,935	4,986
Matteawan	5,807	4,278
Middletown	14,522	11,977
Mount Vernon	20,346	10,830
Newburg	24,943	23,087
New York	3437202	1515301
Niagara Falls	19,457	
No. Tonawanda	9,069	4,793
Norwich	5,766	5,212
Ogdensburg	12,633	11,662
Olean	9,462	7,358
Oneida	6,364	6.083
Oneonta	7,147	6,272
Oswego	22,199	21,842
Owego	5,039	
Peekskill	10,358	9,676
Plattsburg	8,434	7,010
Port Chester	7,440	5,274
Port Jervis	9,385	9.327
Poughkeepsie	24.029	22,206
Rensselaer	7,466	7,301
Rochester	162,608	133,896
Rome	15,343	14.991
Saratoga Sprgs	12,409	11 975
Schenectady	31,682	19.902
Seneca Falls	6,519	6,116
Sing Sing	7,939	9,372
Syracuse	108,374	88.143
Tonawanda	7,421	7,145
Troy	60,651	60,956
Utica	56,383	44,007
Watertown	21,696	14.725
Watervliet	14,321	12,967
White Plains	7.899	4.042
Yonkers	47,931	32,033
NORTH CAROLINA.		
Asheville	14,694	10,235
Charlotte	18,091	11,557
Concord	7,910	4,339
Durham	6,679	5,485
Elizabeth City	6,348	3,251
Goldsboro	5,877	4,017
Greensboro	10,035	3.317
Newbern	9,090	7.843
Raleigh	13,643	12.678
Salisbury	6,277	4,418
Wilmington	20,976	20,056
Winston	10,008	8,018
NORTH DAKOTA.		
Fargo	9.589	5,664
Grand Forks	7,652	4.979
OHIO.		
Akron	42,728	27,601
Alliance	8,974	7,607
Ashtabula	12,949	8,338
Bedford	9,912	9,934
Bellefontaine	6,649	4,245
Bowling Green	5,067	3,467
Buckeye City	6,560	5,974
Cambridge	8,241	4,361
Canal Dover	5,422	3,470
Canton	30,667	26,189
Chillicothe	12,976	11,288

	1900.	1890.
Cincinnati	325,902	296,908
Circleville	6,991	6,556
Cleveland	381,768	261,353
Columbus	125,560	88,150
Conneaut	7,133	3,241
Coshocton	6,473	3,672
Dayton	85,333	61,220
Defiance	7,579	7,694
Delaware	7,940	8,224
East Liverpool	16,485	10,956
Elyria	8,791	5,611
Findlay	17,613	18,553
Fostoria	7,730	7,070
Fremont	8,439	7,141
Galion	7,282	6,326
Gallipolis	5,432	4,498
Glenville	5,588	.....
Greenville	5,501	5,473
Hamilton	23,914	17,565
Ironton	11,868	10,939
Kenton	6,852	5,557
Lancaster	8,991	7,555
Lima	21,723	15,981
Lorain	16,028	4,863
Mansfield	17,640	13,473
Marietta	13,348	8,273
Marion	11,862	8,327
Martin's Ferry	7,760	6,250
Massillon	11,944	10,092
Middletown	9,215	7,681
Mount Vernon	6,633	6,027
Nelsonville	5,421	4,558
Newark	18,157	14,270
Newburg	5,909	.....
New Phila'phia	6,213	4,456
Niles	7,468	4,289
Norwalk	7,074	7,195
Norwood	6,480	.....
Painesville	5,024	4,755
Piqua	12,172	9,090
Portsmouth	17,870	12,394
St. Mary's	5,359	3,000
Salem	7,582	5,780
Sandusky	19,664	18,471
Sidney	5,688	4,850
Springfield	38,253	31,895
Steubenville	14,349	13,394
Tiffin	10,989	10,801
Toledo	131,822	81,434
Troy	5,881	4,494
Urbana	6,808	6,510
Van Wert	6,422	5,512
Warren	8,529	5,973
Wash'ton C. H.	5,751	5,742
Wellston	8,045	4,377
West Alexandria	6,146	5,247
Woodville	6,063	5,901
Xenia	8,696	7,301
Youngstown	44,885	33,220
Zanesville	23,538	21,009
OKLAHOMA.		
Guthrie	10,006	5,733
Oklahoma City	10,037	4,151
OREGON.		
Astoria	8,381	6,184
Baker City	6,663	2,604
Portland	90,426	46,385
PENNSYLVANIA.		
Allegheny	129,896	105,287
Allentown	35,416	25,228
Altoona	38,973	30,337
Archbald	5,396	4,032
Ashland	6,438	7,346
Beaver Falls	10,054	9,735
Bethlehem	7,293	6,672
Bloomsburg	6,170	4,635
Braddock	15,654	8,561
Bradford	15,629	10,514
Bristol	7,104	6,553
Butler	10,853	8,734
Carbondale	13,536	10,833
Carlisle	9,626	7,620
Carnegie	7,330	.....
Chambersburg	8,864	7,863
Charleroi	5,930	.....
Chester	33,988	20,226
Clearfield	5,081	2,248
Coatesville	5,721	3,680
Columbia	12,316	10,599
Connellsville	7,160	5,628
Conshohocken	5,762	5,740
Corry	5,369	5,677
Danville	8,042	7,998
Dubois	9,375	6,149
Dunmore	12,583	8,315
Duquesne	9,036	.....
Easton	25,238	14,481
Edwardsville	5,165	3,284
Erie	52,733	40,634
Etna	5,384	3,767
Franklin	7,317	6,221
Freeland	5,254	1,730
Greensburg	6,508	4,202
Hanover	5,302	3,746
Harrisburg	50,167	39,385
Hazleton	14,230	11,872
Homestead	12,554	7,911
Huntington	6,053	5,729
Jeannette	5,865	3,296
Johnstown	35,936	21,805
Kane	5,296	2,944
Lancaster	41,459	32,011
Lebanon	17,628	14,664
Lock Haven	7,210	7,358
McKeesport	34,227	20,741
McKees Rocks	6,352	1,687
Mahanoy City	13,504	11,286
Meadville	10,291	9,520
Middletown	5,608	5,080
Millvale	6,736	3,800
Milton	6,175	5,317
Monongahela	5,173	4,096
Mount Carmel	13,179	8,254
Nanticoke	12,116	10,044
New Brighton	6,820	5,616
Newcastle	28,339	11,600
Norristown	22,265	19,791
North Braddock	6,535	.....
Oil City	13,264	10,932
Old Forge	5,630	.....
Olyphant	6,180	4,083
Philadelphia	1293697	1046964
Phœnixville	9,196	8,514
Pittsburg	321,616	238,617
Pittston	12,556	10,302
Plymouth	13,649	9,344
Pottstown	13,696	13,285
Pottsville	15,710	14,117
Reading	78,961	58,661
Sayre	5,243	.....
Scranton	102,026	75,215
Shamokin	18,202	14,403
Sharon	8,918	7,459
Sharpsburg	6,842	4,898
Shenandoah	20,321	15,944
S. Bethlehem	13,241	10,302
Skeelton	12,086	9,250
Sunbury	9,810	5,930
Tamaqua	7,267	6,054
Tarentum	5,472	4,627
Titusville	8,244	8,037
Tyrone	5,847	4,705
Uniontown	7,344	6,359
Warren	8,043	4,332
Washington	7,670	7,063
Waynesboro	5,396	3,811
West Chester	9,524	8,028
West Pittston	5,846	3,906
Wilkesbarre	51,721	37,718
Wilkinsburg	11,886	4,662
Williamsport	28,757	27,132
York	33,708	20,793
RHODE ISLAND.		
Bristol	6,901	5,478
Burrillville	6,317	5,492
Central Falls	18,167	.....
Coventry	5,279	5,068
East Providence	12,138	8,422
Lincoln	8,937	20,355
Newport	22,034	19,457
Pawtucket	39,231	27,633
Providence	175,597	132,146
Warren	5,108	4,489
Warwick	21,316	17,761
Westerly	7,541	6,813
Woonsocket	28,204	20,830
SOUTH CAROLINA.		
Anderson	5,498	3,018
Charleston	55,807	54,955
Columbia	21,108	15,353
Greenville	11,860	8,607
Rock Hill	5,485	2,744
Spartanburg	11,395	5,544
Sumter	5,673	3,865
Union	5,400	1,609
SOUTH DAKOTA.		
Lead City	6,210	2,581
Sioux Falls	10,266	10,177
TENNESSEE.		
Bristol	5,271	3,324
Chattanooga	30,154	29,100
Clarksville	9,431	7,924
Columbia	6,052	5,370
Jackson	14,511	10,039
Knoxville	32,637	22,535
Memphis	102,320	64,495
Nashville	80,865	76,168
TEXAS.		
Austin	22,258	14,575
Beaumont	9,427	3,296
Bonham	5,042	3,361
Brenham	5,968	5,209
Brownsville	6,305	6,134
Cleburne	7,493	3,278
Corsicana	9,313	6,285
Dallas	42,638	38,067
Denison	11,807	10,958
El Paso	15,906	10,338
Fort Worth	26,688	23,076
Gainesville	7,874	6,594
Galveston	37,789	29,084
Greenville	6,860	4,330
Hillsboro	5,346	2,541
Houston	44,633	27,557
Laredo	13,429	11,319
Marshall	7,855	7,207
Palestine	8,297	5,838
Paris	9,358	8,254
San Antonio	53,321	37,673
Sherman	10,243	7,335
Temple	7,065	4,047
Terrell	6,330	2,988
Texarkana	5,256	2,852
Tyler	8,069	6,908
Waco	20,686	14,445
UTAH.		
Logan	5,451	4,565
Ogden	16,313	14,889
Provo	6,185	5,159
Salt Lake City	53,531	44,843
VERMONT.		
Barre	8,448	4,146
Bennington	5,656	3,971
Brattleboro	5,297	5,467
Burlington	18,640	14,590
Montpelier	6,266	4,160
Rutland	11,499	11,760
St. Albans	6,239	.....
St. Johnsbury	5,666	3,857
VIRGINIA.		
Alexandria	14,528	14,339
Charlottesville	6,449	5,591
Danville	16,520	10,305
Fredericksburg	5,068	4,528
Lynchburg	18,891	19,709

	1900.	1890.
Manchester	9,715	9,246
Newport News	19,635	4,449
Norfolk	46,624	34,871
Petersburg	21,810	22,680
Portsmouth	17,427	13,268
Richmond	85,050	81,388
Roanoke	21,495	16,159
Staunton	7,289	6,975
Winchester	5,161	5,196
WASHINGTON.		
Everett	7,838	.....
New Whatcom	6,834	.....
Seattle	80,671	42,837
Spokane	36,848	19,922
Tacoma	37,714	36,006
Walla Walla	10,049	4,709
WEST VIRGINIA.		
Charleston	11,099	6,742
Fairmont	5,655	1,023
Grafton	5,650	3,159
Huntington	11,923	10,108
Martinsburg	7,564	7,226
Moundsville	5,362	2,688
Parkersburg	11,703	8,408
Wheeling	38,878	34,522
WISCONSIN.		
Antigo	5,145	4,424
Appleton	15,085	11,869
Ashland	13,074	9,956
Baraboo	5,751	4,605
Beaver Dam	5,128	4,222
Beloit	10,436	6,315
Chippewa Falls	8,094	8,670
Eau Claire	17,517	17,415
Fond du Lac	15,110	12,024
Green Bay	18,684	9,069
Janesville	13,185	10,836
Kaukauna	5,115	4,667
Kenosha	11,606	6,532
La Crosse	28,895	25,090
Madison	19,164	13,426
Manitowoc	11,786	7,710
Marinette	16,195	11,523
Marshfield	5,240	3,450
Menasha	5,589	4,581
Menomonie	5,655	5,491
Merrill	8,537	6,809
Milwaukee	285,315	204,468
Neenah	5,954	5,083
Oconto	5,646	5,219
Oshkosh	28,284	22,836
Portage	5,459	5,143
Racine	29,102	21,014
Sheboygan	22,962	16,359
Stevens Point	9,524	7,896
Superior	31,091	11,983
Watertown	8,437	8,755
Waukesha	7,419	6,321
Wausau	12,354	9,253
WYOMING.		
Cheyenne	14,087	11,690
Laramie	8,207	6,388

CHRONOLOGY OF PROGRESS IN ELECTRICITY.

[Data obtained from historical number of Electrical Review.]

Electric current discovered by Allesandro Volta....1800
Arc light produced by Sir Humphrey Davy....1810
Induction discovered by Faraday....1831
First electric road built by Thomas Davenport of Brandon, Vt....1835
Automobile invented by Davenport....1835
Wheatstone and Cooke system of telegraphy invented....1835
Zinc-copper battery invented by Daniell.1836
Submarine cable laid across Hoogly river.1839
First Morse telegraph line constructed..1844
Printing telegraph system invented by Royal House....1846
Automatic repeaters invented....1848
First long submarine cable laid in British channel....1850
First successful Atlantic cable laid....1858
Electrolytic copper refining invented by James Elkington....1865
Stearns' duplex telegraph system introduced....1872
Edison's quadruplex system introduced..1874
First modern electric road built by George F. Greene of Kalamazoo, Mich.1875
Telephone invented by Bell and Gray...1875
Continuous current dynamo discovered by Gramme....1876
First telephone exchange operated at New Haven, Conn....1878
Incandescent lamp invented by Edison..1879
First central lighting station established in Pearl street, New York....1880
Storage battery, or accumulator, invented by Plantè....1882
First practical trolley line built by J. C. Henry in Kansas City....1884
First European electric road built in Berlin by Siemens Bros....1884
Electricity first used on elevated roads in New York....1885
First long-distance, high-voltage power-transmission plant installed at Pomona, Cal....1892
Telautograph invented by Elisha Gray..1893
Heavy trains moved by electric locomotives in Baltimore....1895
The X-ray discovered by Dr. Wilhelm Konrad Roentgen....1895
Road automobiles come into general use.1897
Transatlantic telephony made possible by Dr. M. I. Pupin....1900
Improved storage battery for automobiles invented by Edison....1901

POPULATION OF THE UNITED STATES AT EACH CENSUS (1850-1900).

[From the reports of the superintendents of the census.]

STATE OR TERRITORY.	1900.		1890.		1880.		1870.		1860.		1850.	
Alabama	18	1,828,697	17	1,513,017	17	1,262,505	16	996,992	13	964,201	12	771,623
Arkansas	25	1,311.564	24	1,128,179	25	802,525	26	484,471	25	435,450	26	209,897
California	21	1,485,053	22	1,208,130	24	864,694	24	560,247	26	379,994	29	92,597
Colorado	31	539,700	31	412,198	35	194,327	....	39,864	....	34,277	....	.....
Connecticut	29	908,420	29	746,258	28	622,700	25	537,454	24	460.147	21	370,792
Delaware	42	184.735	41	168,493	37	146,608	34	125,015	32	112,216	30	91,532
Florida	32	528,542	32	391,422	34	269,493	33	187,748	31	140,424	31	87,445
Georgia	11	2,216,331	12	1,837,353	13	1,542,180	12	1,184,109	11	1,057,286	9	906,185
Idaho	43	161.772	43	84,385	....	.....	....	.....	....	.....	....	.....
Illinois	3	4,821.550	3	3,826,351	4	3,077.871	4	2,539,891	4	1,711,951	11	851,470
Indiana	8	2.516,462	8	2,192,404	6	1,978.301	6	1,680,637	6	1,350,428	7	988,416
Iowa	10	2,231,853	10	1,911,896	10	1,624,615	11	1,194,020	20	674,913	27	192,214
Kansas	22	1,470,495	19	1,427,096	20	996,096	29	364,399	33	107,206	....	.....
Kentucky	12	2,147,174	11	1,858,635	8	1,648,690	8	1,321,011	9	1,155,684	8	982,405
Louisiana	23	1,381,625	25	1,118,587	22	939,946	21	726,915	17	708,002	18	517,762
Maine	30	694,466	30	661,086	27	648,936	23	626,915	22	628,279	16	583,169
Maryland	26	1,188,044	27	1,042,390	23	934,943	20	780,894	19	687,049	17	583,034
Massachusetts	7	2,805.346	6	2,238,943	7	1,783 085	7	1,457,351	7	1,231,066	6	994,514
Michigan	9	2,420,982	9	2,093,889	9	1,636,937	13	1,184,059	16	749.113	20	397,654
Minnesota	19	1,751.394	20	1,301,826	26	780,773	28	439,706	30	172,023	33	6,077
Mississippi	20	1,551.270	21	1.289,600	18	1,131,597	18	827,922	14	791,305	15	606,526
Missouri	5	3,106.665	5	2,679,184	5	2,168,380	5	1,721,295	8	1,182,012	13	682,044
Montana	41	243,329	42	132,159	....	.....	....	.....	....	.....	....	.....
Nebraska	27	1,066,300	26	1,058,910	30	452,402	35	122,993	35	28,841	....	.....
Nevada	45	42.335	45	45,761	38	62,266	37	42,491	36	6,857	....	.....
New Hampshire	36	411,588	33	376,530	31	346,991	31	318,300	27	326,073	22	317,976
New Jersey	16	1,883.669	18	1,444,933	19	1,131,116	17	906,096	21	672,035	19	489,555
New York	1	7,268.894	1	5,997,853	1	5,082,871	1	4,382,759	1	3,880,735	1	3,097,394
North Carolina	15	1,893.810	16	1,617,947	15	1,399,750	14	1,071,361	12	992,622	10	869,039
North Dakota	39	319,146	39	182,719	....	.....	....	.....	....	.....	....	.....
Ohio	4	4,157.545	4	3,672,316	3	3,198,062	3	2,665,260	3	2,339,511	3	1,980,329
Oregon	35	413.536	38	313.767	36	174,768	36	90,923	34	52,465	32	13,294
Pennsylvania	2	6,302.115	2	5,258,014	2	4,282,891	2	3,521,951	2	2,906,215	2	2,311,786
Rhode Island	34	428.556	35	345,506	33	276,531	32	217,353	29	174,620	28	147,545
South Carolina	24	1,340.316	23	1,151,149	21	995,577	22	705,606	18	703,708	14	668.507
South Dakota	37	401.570	37	328,808	....	.....	....	.....	....	.....	....	.....
Tennessee	13	2,020.616	13	1,767,518	12	1,542,359	9	1,258,520	10	1,109,801	5	1,002,717
Texas	6	3,048.710	7	2,235,523	11	1,591,749	19	818,579	23	604,215	25	212,592
Utah	40	276,749	40	207,905	....	.....	....	.....	....	.....	....	.....
Vermont	38	343,641	36	332,422	32	332,286	30	330,551	28	315,098	23	314,120
Virginia	17	1,854,184	15	1,655,980	14	1,512,565	10	1,225,163	5	1,596,318	4	1,421,661
Washington	33	518.103	34	349,390	....	.....	....	.....	....	.....	....	.....
West Virginia	28	958.800	28	762,794	29	618,457	27	442,014	....	.....	....	.....
Wisconsin	14	2,069.042	14	1,686,880	16	1,315,497	15	1,054,670	15	775,881	24	305,391
Wyoming	44	92,531	44	60,705	....	.....	....	.....	....	.....	....	.....
The states	....	74,610,523	....	62,116,811	....	49,371,340	....	38,155,505	....	31,218,021	....	23,067,262
Alaska	7	63.592	6	.....	....	.....	....	.....	....	.....	....	.....
Arizona	6	122,931	5	59,620	6	40,440	9	9,658	....	.....	....	.....
Dakota	....	.....	....	.....	3	135,177	8	14,181	6	4,837	....	.....
Dist. of Columbia	3	278.718	1	230,392	1	177,624	1	131,700	2	75,080	2	51,687
Hawaii	5	154,061	....	.....	....	.....	....	.....	....	.....	....	.....
Idaho	....	.....	....	.....	....	32,610	7	.....	....	.....	....	.....
Indian Territory	2	392,060	2	.....	8	.....	....	14,999	....	.....	....	.....
Montana	....	.....	....	.....	....	39,159	6	.....	....	.....	....	.....
New Mexico	4	195.310	3	153.593	7	119,565	2	20.595	1	93,516	1	61,547
Oklahoma	1	398,331	4	61,834	4	.....	....	91,874	....	.....	....	.....
Persons in service of the U. S. stationed abroad	....	91,219	....	.....	....	.....	....	.....	....	.....	....	.....
Utah	....	.....	....	.....	....	143,963	....	86,786	....	40,273	....	11,380
Washington	....	.....	....	.....	5	75,116	5	23,955	5	11,594	....	.....
Wyoming	....	.....	....	.....	9	20,789	10	9,118	....	.....	....	.....
The territories	....	1.604.913	....	505,439	....	784,443	....	402,866	....	225,300	....	124,614
United States	....	76,303,387	....	62,622,250	....	50,155,783	....	38,558,371	....	31,443,321	....	23,191,876
Per cent of gain		21.		24.9		30.08		22.65		35.58		35.86

NOTE—The narrow column under each census year shows the order of the states and territories when arranged according to magnitude of population.

POPULATION OF THE UNITED STATES AT EACH CENSUS (1790-1840).

[From the reports of the superintendents of the census.]

STATE OR TERRITORY.	1840.		1830.		1820.		1810.		1800.		1790.	
Alabama	12	590,756	15	309,527	19	127,901	....	....	....	....	....	....
Arkansas	25	97,574	27	30,388	25	14,273	....	....	....	....	....	....
California	....	....	....	....	....	....	....	....	....	....	....	....
Colorado	....	....	....	....	....	....	....	....	....	....	....	....
Connecticut	20	309,978	16	297,675	14	275,248	9	261,942	8	251,002	8	237,964
Delaware	26	78,085	24	76,748	22	72,749	19	72,674	17	64,273	16	59,096
Florida	27	54,477	25	34,730	....	....	....	....	....	....	....	....
Georgia	9	691,392	10	516,823	11	340,989	11	252,433	12	162,686	13	82,548
Idaho	....	....	....	....	....	....	....	....	....	....	....	....
Illinois	14	476,183	20	157,445	24	55,211	23	12,282	....	....	....	....
Indiana	10	685,866	13	343,031	18	147,178	21	24,520	20	5,641	....	....
Iowa	28	43,112	....	....	....	....	....	....	....	....	....	....
Kansas	....	....	....	....	....	....	....	....	....	....	....	....
Kentucky	6	779,828	6	687,917	6	564,317	7	406,511	9	220,955	14	73,677
Louisiana	19	352,411	19	215,739	17	153,407	18	76,556	....	....	....	....
Maine	13	501,793	12	399,455	12	298,335	14	228,705	14	151,719	11	96,540
Maryland	15	470,019	11	447,040	10	407,350	8	380,546	7	341,548	6	319,728
Massachusetts	8	737,699	8	610,408	7	523,287	5	472,040	5	422,845	4	378,787
Michigan	23	212,267	26	31,639	26	8,765	24	4,762	....	....	....	....
Minnesota	....	....	....	....	....	....	....	....	....	....	....	....
Mississippi	17	375,651	22	136,621	21	75,448	20	40,352	19	8,850	....	....
Missouri	16	383,702	21	140,455	23	66,586	22	20,845	....	....	....	....
Montana	....	....	....	....	....	....	....	....	....	....	....	....
Nebraska	....	....	....	....	....	....	....	....	....	....	....	....
Nevada	....	....	....	....	....	....	....	....	....	....	....	....
New Hampshire	22	284,574	18	269,328	15	244,161	16	214,460	11	183,858	10	141,885
New Jersey	18	373,306	14	320,823	13	277,575	12	245,562	10	211,149	9	184,139
New York	1	2,428,921	1	1,918,608	1	1,372,812	2	959,049	3	589,051	5	340,120
North Carolina	7	753,419	5	737,987	4	638,829	4	555,500	4	478,103	3	393,751
North Dakota	....	....	....	....	....	....	....	....	....	....	....	....
Ohio	3	1,519,467	4	937,903	5	581,434	13	230,760	18	45,365	....	....
Oregon	....	....	....	....	....	....	....	....	....	....	....	....
Pennsylvania	2	1,724,033	2	1,348,233	3	1,049,458	3	810,091	3	602,365	2	434,373
Rhode Island	24	108,830	23	97,199	20	83,059	17	76,931	16	69,122	15	68,825
South Carolina	11	594,398	9	581,185	8	502,741	6	415,115	6	345,591	7	249,073
South Dakota	....	....	....	....	....	....	....	....	....	....	....	....
Tennessee	5	829,210	7	681,904	9	422,823	10	261,727	15	105,602	17	35,691
Texas	....	....	....	....	....	....	....	....	....	....	....	....
Vermont	21	291,948	17	280,652	16	235,966	15	235,981	13	154,465	12	85,425
Virginia	4	1,239,797	3	1,211,405	2	1,065,366	1	974,600	1	880,200	1	747,610
Washington	....	....	....	....	....	....	....	....	....	....	....	....
West Virginia	....	....	....	....	....	....	....	....	....	....	....	....
Wisconsin	29	30,945	....	....	....	....	....	....	....	....	....	....
Wyoming	....	....	....	....	....	....	....	....	....	....	....	....
The states	....	17,019,641	....	12,820,868	....	9,600,783	....	7,215,858	....	5,294,390	....	....
Alaska	....	....	....	....	....	....	....	....	....	....	....	....
Arizona	....	....	....	....	....	....	....	....	....	....	....	....
Dakota	....	....	....	....	....	....	....	....	....	....	....	....
Dist. of Columbia	1	43,712	1	39,834	1	33,039	1	24,023	1	14,093	....	....
Idaho	....	....	....	....	....	....	....	....	....	....	....	....
Indian Territory	....	....	....	....	....	....	....	....	....	....	....	....
Montana	....	....	....	....	....	....	....	....	....	....	....	....
New Mexico	....	....	....	....	....	....	....	....	....	....	....	....
Oklahoma	....	....	....	....	....	....	....	....	....	....	....	....
Utah	....	....	....	....	....	....	....	....	....	....	....	....
Washington	....	....	....	....	....	....	....	....	....	....	....	....
Wyoming	....	....	....	....	....	....	....	....	....	....	....	....
The territories	....	43,712	....	39,834	....	33,039	....	24,023	....	14,093	....	....
On public ships in service of U. S.	....	6,100	....	5,318	....	....	....	....	....	....	....	....
United States	....	17,069,453	....	12,866,020	....	9,638,453	....	7,239,881	....	5,308,483	....	3,929,214
Per cent of gain		32.67		33.55		33.06		36.38		35.10		....

NOTE—The narrow column under each census year shows the order of the states and territories when arranged according to magnitude of population.

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GROWTH OF AMERICAN CITIES (1790-1900).

CITY.	1900.	1890.	1880.	1870.	1860.	1850.	1840.	1830.	1820.	1810.	1800.	1790.
Albany, N. Y.....	94,151	94,923	90.758	69,422	62,367	50,763	33,721	24.209	12,630	10,762	5,349	3,498
Allegheny, Pa...	129,896	105.287	78,682	53,180	28,702	21,265	10,089	2,801	.....	.....	.....	.....
Atlanta, Ga.....	89,872	65,533	37,409	21,789	9,554	2.572	.....	.....	.....	.....	.....	.....
Baltimore, Md...	508,957	434.439	332,313	267,354	212,418	169,054	102,313	80,620	62,738	46,555	26,514	13,503
Boston, Mass....	560,892	448,477	362,839	250.526	177,840	136,881	93,383	61,392	43,298	33,250	24,737	18,038
Bridgeport, Ct...	70,996	48.866	27,643	18.969	13,299	7,560	3,294	2.800	1,500	1,089	.....	.....
Buffalo, N. Y.....	352,387	255,664	155,134	117, 714	81,129	42,261	18,312	8,668	2,095	.....	.....	.....
Cambridge, Mass.	91,886	70.028	52,669	39.634	26,060	15,215	8,409	6,072	3,295	2,323	2.453	2,115
Camden, N. J....	75,935	58,313	41,659	20,045	14,358	9.479	3,371	.....	.....	.....	.....	.....
Charleston, S. C..	55,807	54.955	49,984	48,956	40.522	42.985	29,261	30.289	24,780	24, 711	18, 924	16,359
Chicago, Ill.....	1,698,575	1,099.850	503.185	298, 977	109, 260	29,963	4,470	.....	.....	.....	.....	.....
Cincinnati, O....	325.902	296,908	255,139	216. 239	161, 014	115, 435	46,338	24.831	9,642	2,540	.....	.....
Cleveland, O.....	381.768	261,353	160,146	92,829	43,417	17.034	6,071	1,076	606	.....	.....	.....
Columbus, O.....	125,560	88.150	51,617	31,274	18,554	17.882	6.048	2,455	.....	.....	.....	.....
Dayton, O..... ..	85.333	61,220	38.678	30,473	20,081	10,977	6,067	2,950	1,000	383	.....	.....
Denver, Col.....	133,859	106,713	35,629	4.759	4,749	.....	.....	.....	.....	.....	.....	.....
Des Moines, Iowa	62.139	50,093	22,408	12.035	3,965	502	.....	.....	.....	.....	.....	.....
Detroit, Mich....	285,704	205.876	116.340	79.577	45,619	21,019	9,102	2,222	1,422	.....	.....	.....
Duluth, Minn....	52,969	33,115	3,483	3.131	.....	.....	.....	.....	.....	.....	.....	.....
Erie, Pa.....	52.733	40,634	27,737	19,646	9,419	5,858	3,412	1,465	635	394	81	.....
Evansville, Ind..	59,007	50.756	29.280	21.830	11,484	3,235	.....	.....	.....	.....	.....	.....
Fall River, Mass.	104,863	74,398	48,961	26.766	14,026	11.524	6,738	4,158	1,594	1,296	.....	.....
Gr. Rapids, Mich.	87,565	60,278	32.016	16.507	8,058	2,686	.....	.....	.....	.....	.....	.....
Harrisburg, Pa..	50,167	39,385	30,762	23.104	13,405	7,834	5,980	4,312	2,990	2,287	1,472	.....
Hartford, Conn..	79,850	53,230	42,015	37,180	29,152	17,966	9,468	7,074	4,726	3,955	5,347	.....
Indianapolis, Ind	169,164	105,436	75,056	48,244	18,611	8,091	2,692	.....	.....	.....	.....	.....
Jersey City, N. J.	206,433	163,003	120,722	82,546	29,226	6,856	3,072	.....	.....	.....	.....	.....
Kansas City, Kas	51,418	38.316	3,200	.....	.....	.....	.....	.....	.....	.....	.....	.....
Kansas City, Mo.	163,752	132,716	55 785	32,260	4,418	.....	.....	.....	.....	.....	.....	.....
Lawrence, Mass..	62,559	44.654	39,151	28,921	17,639	8,282	.....	.....	.....	.....	.....	.....
Los Angeles, Cal.	102,479	50,395	11,183	5,728	4,385	1,610	.....	.....	.....	.....	.....	.....
Louisville, Ky....	204,731	161,129	123,758	100, 753	68.033	43,194	21,210	10,341	4,012	1,357	359	200
Lowell, Mass.....	94,969	77,696	59,475	40 928	36,827	33,383	20,796	6,471	.....	.....	.....	.....
Lynn, Mass.....	68.513	55.727	38,274	28.233	19.083	14.257	9,367	6,138	4,515	4,087	2,837	2,291
Memphis, Tenn..	102,320	64,495	33,592	40,226	22,623	8,841	.....	.....	.....	.....	.....	.....
Milwaukee, Wis.	285.315	204,468	115,587	71,440	45,246	20,061	1,712	.....	.....	.....	.....	.....
Minneapolis.....	202,718	164,738	46,887	13,066	2,564	.....	.....	.....	.....	.....	.....	.....
Nashville, Tenn.	80,865	76.168	43,350	25,865	16,988	10,165	6,929	5,566	.....	.....	.....	.....
Newark, N. J.....	246.070	181,830	136,508	105,059	71,941	38,894	17,290	10,953	6,507	.....	.....	.....
New Haven, Ct...	108,027	81,298	62,882	50,840	39,267	20,345	12,960	10,180	7,147	5,772	4,049	.....
New Orleans, La.	287,104	242,039	216.090	191,418	168,675	116,375	102,193	29,737	27,176	17,224	.....	.....
New York, N. Y.*	3,437.202	1.515.301	1,206,299	942,292	813,669	515,547	312,710	202,589	123,706	96,373	60,515	33.131
Oakland, Cal.....	66,960	48,682	34.555	10,500	1,543	.....	.....	.....	.....	.....	.....	.....
Omaha, Neb.....	102.555	140,452	30,518	16,083	1,883	.....	.....	.....	.....	.....	.....	.....
Paterson, N. J....	105.171	78.347	51,031	33,579	19.586	11.344	7,596	.....	.....	.....	.....	.....
Peoria, Ill.....	56,100	41,024	29,259	22,849	14,045	5,095	1,467	.....	.....	.....	.....	.....
Philadelphia, Pa.	1,293,697	1,046,964	847,170	674, 022	565, 529	121, 376	93,665	80,462	63.802	53, 722	41, 220	28, 522
Pittsburg, Pa....	321,616	238,617	156,389	86,076	49,217	46.601	21,115	12,568	7,248	4,768	1,565	.....
Portland, Me.....	50,145	36,425	33,810	31.413	26.311	20,815	15,218	12,598	8,581	6,921	3,704	2,233
Portland, Ore....	90,426	46,385	17,577	8,293	2.874	821	.....	.....	.....	.....	.....	.....
Providence, R. I.	175,597	132,146	104,857	68.904	50,666	41,513	23,171	16.833	11,767	10.071	7,614	6,380
Reading, Pa.....	78,961	58,661	43.278	33,930	23,162	15.743	8,410	5,856	4,332	3,462	2.386	.....
Richmond, Va...	85,050	81,388	63.600	51,038	37,910	27,570	20,153	16.060	12,067	9,736	5,737	3,761
Rochester, N. Y..	162,608	133,896	98,366	62,386	48,204	36,403	20,191	9.207	2,063	.....	.....	.....
Salt Lake City, U.	53,531	44,843	20,768	12,854	8,236	.....	.....	.....	.....	.....	.....	.....
San Antonio, Tex	53.321	37,637	20.550	12.256	8,235	3,488	.....	.....	.....	.....	.....	.....
San Francisco....	342,782	298,997	233.959	149.473	56,802	34,776	500	.....	.....	.....	.....	.....
Savannah, Ga...	54,244	43.189	30,709	28.235	22,292	15,312	11,214	7,776	7,523	5,215	5,166	.....
Scranton, Pa....	102.026	75,215	45.850	35,092	9,223	.....	.....	.....	.....	.....	.....	.....
Seattle, Wash....	80,671	42,837	3,533	1,107	263	.....	.....	.....	.....	.....	.....	.....
Springfield, Mass	62.059	44,179	83,340	26,703	15,199	11,766	10,985	6.784	3,914	2,767	2.312	1,574
St. Joseph, Mo...	102,979	52.324	32.431	19,556	8,922	.....	.....	.....	.....	.....	.....	.....
St. Louis, Mo.†...	575.238	451,770	350,518	310, 864	160, 773	77,860	16,469	14,125	10,049	.....	.....	.....
St. Paul, Minn...	163.065	133,156	41,473	20,030	10,401	1,112	.....	.....	.....	.....	.....	.....
Syracuse, N. Y...	108,374	88.143	51,792	43.051	28,119	22,271	11,014	6,929	1,814	.....	.....	.....
Toledo, O.....	131,822	81,434	50,137	31,584	13,768	3,829	1,222	.....	.....	.....	.....	.....
Trenton, N. J.....	73,307	57,458	29,910	22,874	17,228	6,461	4,035	3,925	3,942	.....	.....	.....
Troy, N. Y.....	60,651	60,956	56,747	46,465	39.235	28,785	19,334	11.556	5,264	3,895	4,926	.....
Utica, N. Y.....	56.383	44,007	33,914	28,804	22.529	17,565	12.782	8,323	2.972	.....	.....	.....
Washington, D.C.	278.718	230.392	177.624	131,700	75,080	51.687	33,745	30,261	23,336	15,471	8,144	.....
Wilkesbarre, Pa..	51,721	37,718	23,339	10,174	4,235	2,723	1,718	2,232	755	1,225	835	.....
Wilmington, Del.	76.508	61,431	42,478	30,841	21,258	13.979	8,367	.....	.....	.....	.....	.....
Worcester, Mass	118,421	84,655	58.291	41.105	24,960	17.049	7,497	4,137	2,962	2,577	2.411	2,095

*The population of New York city as at present constituted is estimated by the director of the census to have been: 1790, 49,401; 1800, 79,216; 1810, 119,734; 1820, 152,056; 1830, 242,278; 1840, 391,114; 1850, 696,115; 1860, 1,174,779; 1870, 1,478,103; 1880, 1,911,698; 1890, 2,507,414; 1900, 3,437,202.

†Prior to census of 1880 St Louis city was an undivided part of St. Louis county and its population was not separately reported. Previous to that year the population given is that of the city and county of St. Louis combined. Unofficial figures give St. Louis proper 1,400 population in 1810; 4,598 in 1820 and 6,694 in 1830

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